SANCROX QUARRY EXPANSION PROJECT

State Significant Development (SSD 7293)
Biodiversity Assessment Report - RTS Final Version

Prepared for: Hanson Heidelberg Cement Group

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Hanson Heidelberg Cement Group. Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.11478.00100-R01-v2.5	13 May 2021	Jeremy Pepper, M Consterdine	J Pepper	J Pepper

EXECUTIVE SUMMARY

Project Description

Hanson Construction Materials Pty Ltd is seeking project approval for the expansion of the existing Sancrox hard rock quarry, located on Sancrox Road, Sancrox. The Sancrox Quarry Expansion Project will involve extending the life of the quarry to 30 years and increasing approved extraction limits of 175,000 m^3. The Project will be assessed as a State Significant Development (SSD 7293) as defined under *State Environmental Planning Policy (State and Regional Development) 2011*, and will require development consent under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979*. Under the *NSW Biodiversity Offsets Policy for Major Projects,* impacts on biodiversity values are assessed according to the *Framework for Biodiversity Assessment* (FBA). A *Biodiversity Assessment Report* is required to describe the biodiversity values present on the development site and the impact of the Major Project on these values.

Existing Biodiversity Values

Field surveys were completed in accordance with the relevant sections of the FBA and comprised targeted surveys for threatened orchid species (completed 16 October 2015), BioBanking plot based vegetation and habitat surveys, diurnal and nocturnal surveys targeting relevant threatened fauna (completed 30 November to 4 December 2015) and additional surveys targeting threatened nocturnal fauna (completed 14 and 15 December 2015). Supplementary surveys for the Koala were also conducted in October 2020.

Vegetation and Plant Communities

The Development Site contains stands of native forest, along with areas of cleared and disturbed land and constructed ponds for water retention around the existing pit. Native vegetation within the Development Site has been described in terms of Plant Community Types (PCTs), with two PCTs identified and mapped across the site, as follows:

- PCT 1215 (NR 247) Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion (11.08 ha); and
- PCT 1265 (NR 263) Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast (27.94 ha).

Neither of these PCTs is listed as a threatened ecological community under the NSW *Biodiversity Conservation Act 2016* (BC Act). A small stand of Blackbutt - Pink Bloodwood shrubby open forest (PCT 686) was previously located within the southern/central portion of the Development Site; however, the proposed pit layout has been amended to exclude this patch of vegetation, which is identified as the threatened ecological community *Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion*.

No significant state or regional biodiversity links have been mapped on the Development Site; however aerial imagery identified two local links that traverse the site that contribute to vegetation connectivity in the area. There is also a portion of a “sub-regional biodiversity corridor” mapped in the Greater Sancrox Structure Plan, which traverses south-north through the centre of the Development Site.

EXECUTIVE SUMMARY

Flora and Fauna Habitats

During the field surveys habitat features, such as hollow-bearing trees, were recorded throughout the Development Site. No naturally occurring aquatic habitats were recorded as the site contains only ephemeral (unnamed) first and second order watercourses, most of which drain into retention dams constructed as part of the existing quarry.

Threatened Species

A total of eight threatened species listed under the BC Act, all of which generate ecosystem credits (for foraging habitat), were recorded on site: Eastern Freetail-bat, Eastern False Pipistrelle, Greater Broad-nosed Bat, Yellow-bellied Sheathtail-bat, Little Bent-wing Bat, Eastern Bentwing-bat, Grey-headed Flying-fox and Koala. One species credit species, the Koala (*Phascolarctos cinereus)* was recorded on site and the forested parts of the site contain Koala feed trees and constitute habitat for this species.

No threatened flora species were recorded on the Development Site, despite targeted surveys during the known flowering periods for relevant species.

Biodiversity Impacts

The direct impacts associated with the project include the clearing of 39.02 ha of native forest vegetation. Other impacts include the loss of hollow-bearing trees, which may provide potential breeding habitat and roost sites for a number of arboreal mammals, microchiropteran bats and bird species and the removal of foraging habitat for native fauna.

The clearing of 39.02 ha of native forest vegetation has been quantified in terms of biodiversity credits, with the proposed clearing resulting in the generation of 2,230 ecosystem credits. The type and number of ecosystem credits generated by the proposed vegetation removal is as follows:

- Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion (NR247) – 505 credits; and
- Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast (NR263) – 1725 credits.

The proposed development will require the removal of 39.02 ha of Koala habitat. According to the FBA, this will necessitate the retirement of 1015 species credits to offset the loss of habitat There are no other species credits generated as a result of the impacts associated with the project.

EPBC Act

One matter of national environmental significance, the Koala, which is listed as 'vulnerable' under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), was recorded. Given the proposed removal of koala habitat associated with the development, a referral has been prepared and submitted to the Department of Agriculture, Water and the Environment for determination under the EPBC Act.

EXECUTIVE SUMMARY

Impact Avoidance, Mitigation and Offsetting

Impact avoidance measures for the project have involved site selection and optimisation of the development footprint. A selection of management practices and mitigation measures will be implemented during construction and operation, including a site-specific *Operational Environmental Management Plan* and a *Landscaping Strategy*, to minimise impacts on biodiversity values.

The assessment has determined that a biodiversity offset is required in accordance with the FBA. The offset comprises a combination of ecosystem credits and species credits, as follows:

- 505 ecosystem credits of Spotted Gum - Grey Ironbark open forest (NR247)
- 1725 ecosystem credits of Tallowwood - Small-fruited Grey Gum dry grassy open forest (NR263)
- 1015 Koala species credits

Biodiversity offsets under the FBA are generally secured prior to commencement of construction, although this can be deferred if a Voluntary Planning Agreement (under the *Environmental Planning and Assessment Act 1979*) is entered into prior to project approval. The offset will be secured through a combination of purchase and retirement of biodiversity credits from the credit market, creation of credits through a Stewardship Agreement on surplus lands within the study area and/ or payment of an equivalent monetary value into the Biodiversity Conservation Fund.

CONTENTS

CONTENTS

CONTENTS

CONTENTS

DOCUMENT REFERENCES

TABLES

CONTENTS

FIGURES

PHOTOS

APPENDICES

1 Introduction

1.1 Background

SLR Consulting Australia (SLR) has been engaged to prepare a BioBanking Assessment Report (BAR) to support an application by Hanson Construction Materials Pty Ltd seeking project approval for expansion of the existing Sancrox hard rock quarry. The Sancrox Quarry (including the proposed development site) is located approximately 8 kilometres (km) west of Port Macquarie, within the Port Macquarie local government area on the Mid North Coast of New South Wales (NSW) (**Figure 1**).

The Project will be assessed as a State Significant Development (SSD) as defined under *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP), and will require development consent under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). As such, an environmental impact statement (EIS) will be required to be prepared to support the project application under the SSD process. It is intended that this BAR informs the EIS and will be included as a technical document in the EIS.

The Secretary's Environmental Assessment Requirements (SEARs) for the EIS, as issued by the Secretary of the Department of Planning and Environment (DP&E), require the preparation of a Biodiversity Assessment Report (BAR) in accordance with the *Framework for Biodiversity Assessment* (FBA). A copy of the SEARs that apply to this BAR, including the DP&E summary of requirements and the detailed requirements of the NSW Office of Environment and Heritage (OEH), are provided in **Appendix A.** The relevant SEARs and a listing of where they are addressed in this BAR are summarised in **Section 1.4**.

This BAR has been updated in May 2019 to address comments from OEH as part of the adequacy review of the EIS.

1.2 Proposed Development Site

The general location and features of the site and study area are displayed in the Site Map, which is provided in **Figure 2**. In accordance with the FBA, the Site Map contains the following features:

- Boundary of the development site;
- Lot boundaries and labels (i.e. cadastre);
- IBRA region and subregion;
- Mitchell landscapes;
- Rivers and streams (no wetlands are present); and
- Extent of native vegetation.

The study area, including the quarry lands owned by Hanson, comprises approximately 145 hectares (ha) of which 6.5 ha is currently occupied by the quarry and its facilities. The site is identified as Lot 1 in DP 702807, Lot 1 in DP 704890, Lot 2 in DP 574308 and Lot 353 in DP 754434. There is also a parcel of Crown Land separating Lot 2 into a north and a south section. The site is zoned RU1 (Primary Production) under the *Hastings Local Environmental Plan 2011*.

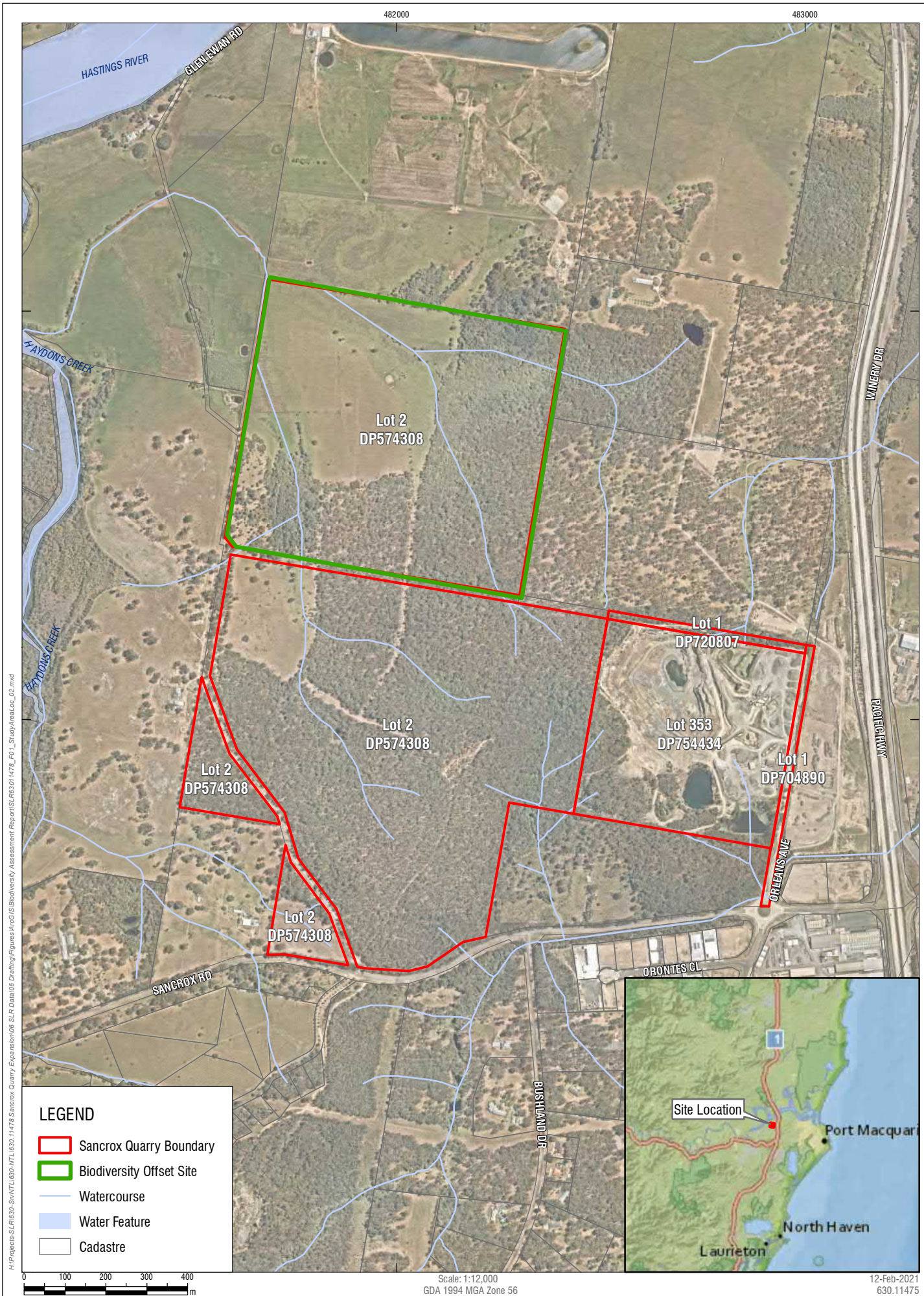
The site is located within the Port Macquarie-Hastings Local Government Area (LGA), Northern Rivers CMA and the NSW North Coast IBRA region and Macleay-Hastings sub-region. The Wauchope Coastal Foothills Mitchell landscape is mapped as occurring over the vast majority of the development site, with the Manning-Macleay Coastal Alluvial Plain landscape mapped as occurring across the northwestern parts of the study area (**Figure 2**).

There are no wetlands, rivers or streams traversing the development site, although a number of small ephemeral (and unnamed) first and second order watercourses are present, with two draining to the west and then north (beyond the site boundary) to Haydons Creek and then eventually the Hastings River. Other small tributaries drain south to the road drainage system of Sancrox Road or to the artificial dams located within the existing quarry area (**Figure 2**).

The vegetation within the study area and surrounding land is predominately native woody vegetation, interspersed with large expanses of cleared grassland (predominantly used for stock grazing), some areas of industrial use (i.e. the Sancrox industrial estate to the south) and major infrastructure of the Pacific Highway to the west (**Figure 2**). The southern parts of Lot 2 contain mostly white stringy bark-tallowwood-grey gum dry forest with patches of spotted grey gum grassy dry forest. The northern parts of Lot 2 contain stands of broad-leaved paperbark-mixed eucalypt swamp forest complex and stands of swamp mahogany-swamp forest. There are also small stands of flax-leaved paperbark-eucalyptus-prickly leaved tea tree forests among larger communities of white stringybark-tallowwood-grey gum dry forest.

The topography of the development site is varied, ranging between approximately 4 metres Australian Height Datum (AHD) and 62 metres AHD. The site area includes sections of steep slopes and ridgelines. The visual amenity is that of woodland with a small amount of disturbed land outside the area of current operations. There are two man-made ponds on the site as well as a drainage line that run from north to south.

There are patches of cleared grassland in the western and northwestern parts of Lot 2, which lie in the western margins of the study area and are currently subject to cattle grazing.



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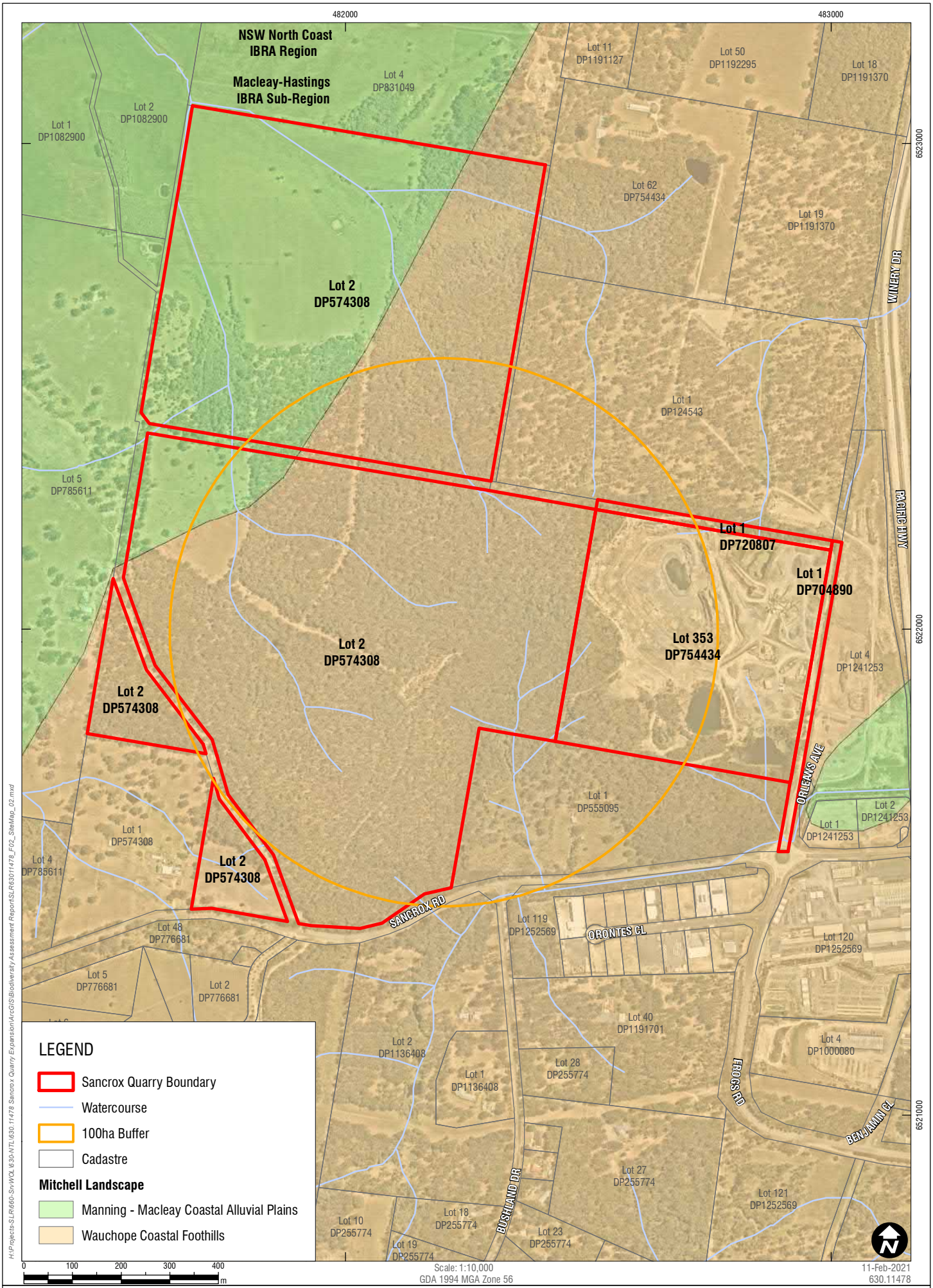
Data Source: NSW SS 2020
Aerial imagery supplied by Nearmap (November, 2020)

Study Area and Regional Location

FIGURE 1



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Data Source: NSW SS 2020
Aerial imagery supplied by Nearmap (November, 2020)

Site Map

FIGURE 2

1.3 Proposed Development

The information provided in this section is drawn from the *Preliminary Environmental Assessment* (Hanson 2015).

Hanson is seeking development consent under Part 4 of the EP&A Act to expand the quarry to extract and distribute construction materials for civil infrastructure, concrete and road construction projects. The proposed development will involve extending the life of the quarry to 30 years and increasing the approved extraction limit of 185,000 tonnes per annum (as per both DA1995/0193 and DA2004/609), to 530,000 tonnes per annum.

The development will comprise expansion of the quarry footprint in a westerly direction into Lot 2, DP 574308 (**Figure 1**). This will include an upgrade and relocation of the existing infrastructure area including processing plant, offices, weighbridge, and workshop. Additionally the project includes the proposal for the construction of a concrete batching plant, concrete recycling facility, asphalt plant and pug mil. **Figure 3** shows the proposed extraction limit and infrastructure area.

Hanson is also seeking to enclose and purchase a parcel of Crown land, pursuant to the NSW *Roads Act 1993*, which splits Lot 2 (DP 574308), into northern and southern portions (**Figure 2**). This purchase will enable the methodical development of the quarry site.

1.3.1 Ancillary Infrastructure

The proposed project will involve an upgrade and relocation of the existing infrastructure area including processing plant, offices, weighbridge, and workshop. Additionally the project includes the proposal for the construction of a concrete batching plant, concrete recycling facility, asphalt plant and pug mil on site. The concrete plant will supply concrete within the local markets. The plant will produce approximately 20,000 m^3 of concrete each year. The plant infrastructure will be constructed on a concrete hard stand area and water runoff will be managed on site. The plant would consist of upright silo(s), incline conveyor belt, load bins, admixture bunded area, and batch room/amenities.

Other ancillary works include a noise mound, which is to be constructed along the southern boundary of the site, and the establishment of an asset protection zone (APZ) around the administration buildings in the eastern parts of the site (within the existing quarry area) as depicted in **Figure 3**.

1.3.2 Operational Development Footprint

The layout of the proposed development is displayed in **Figure 3**. The total development footprint is 57.55 ha, comprising the proposed pit expansion area and the proposed infrastructure area (containing plant, stockpiles, access tracks, administration building, etc). Both areas include the current (and historically cleared and disturbed) quarry footprint.

Importantly, the proposed quarry footprint area assessed in this BAR was adjusted after the assessment, to avoid a mapped flood risk area. As a result, the quarry pit area was reduced by around three hectares in the northwestern corner of the pit. The current quarry layout is presented in **Figure 3.**

Conversely, since the original BAR assessment was completed, the proposed development footprint now includes a noise attenuation structure (mound or bund) along the southern boundary, which will require additional vegetation removal.

In addition to extraction, the proposed development will also include the following operational activities:

- Blasting: 8 am – 5 pm Monday to Friday;
- Truck movements and equipment loading: 5 am to 10 pm, 7 days a week;
- Quarry operations (incl. production and maintenance): 5 am to 10 pm, 7 days a week;
- Concrete batching plant - 20,000 m^3 per year;
- Concrete recycling plant - 20, 000 tonnes per year; and
- Constructing and operating an asphalt plant producing 50,000 tonnes per annum.

Further details on the Project are provided in the accompanying EIS and Response to Submissions (RTS).

1.4 Scope and Aims of this Report (SEARs)

Under the *NSW Biodiversity Offsets Policy for Major Projects* (NSW Government & OEH 2014), the SEARs require a proponent to apply the Framework for Biodiversity Assessment (FBA) to assess impacts on biodiversity. The FBA is also applied to identify reasonable measures and strategies that can bel taken to avoid and minimise impacts on biodiversity. A Biodiversity Assessment Report (BAR) is required to describe the biodiversity values present on the development site and the impact of the Major Project on these values. Additionally, a Biodiversity Offset Strategy (BOS) is required to outline how the proponent intends to offset the impacts of the Major Project. These reports form part of the EIS.

The Department of Planning and Environment provided the SEARs for the Sancrox Quarry Extension Project (SSD 7293) on 19 October 2015. Biodiversity was identified as an issue in the SEARs and was "*to be assessed and documented in accordance with the Framework for Biodiversity Assessment…*" As the two year validity period on the original SEARs lapsed, revised SEARs were issued in September 2017. An excerpt of the revised SEARs is provided in **Appendix A** of this report.

Table 1 lists the revised SEARs that are relevant to biodiversity. Of particular note is the requirement (as stated in the revised agency letter from OEH) for the biodiversity assessment to be prepared according to the Biodiversity Assessment Method (BAM), pursuant to the NSW *Biodiversity Conservation Act 2016* (BC Act), which came into effect on 25 August 2017 (**Table 1**). However, the transitional arrangements for the BC Act allow for biodiversity assessments for State Significant Developments to be prepared under the former legislation for which SEARs were issued prior to 25 August 2017. Accordingly, this Biodiversity Assessment Report has been prepared according to the FBA, pursuant to the (former) *Threatened Species Conservation Act 1995* (as amended).

Table 1 Revised SEARs relating to Biodiversity

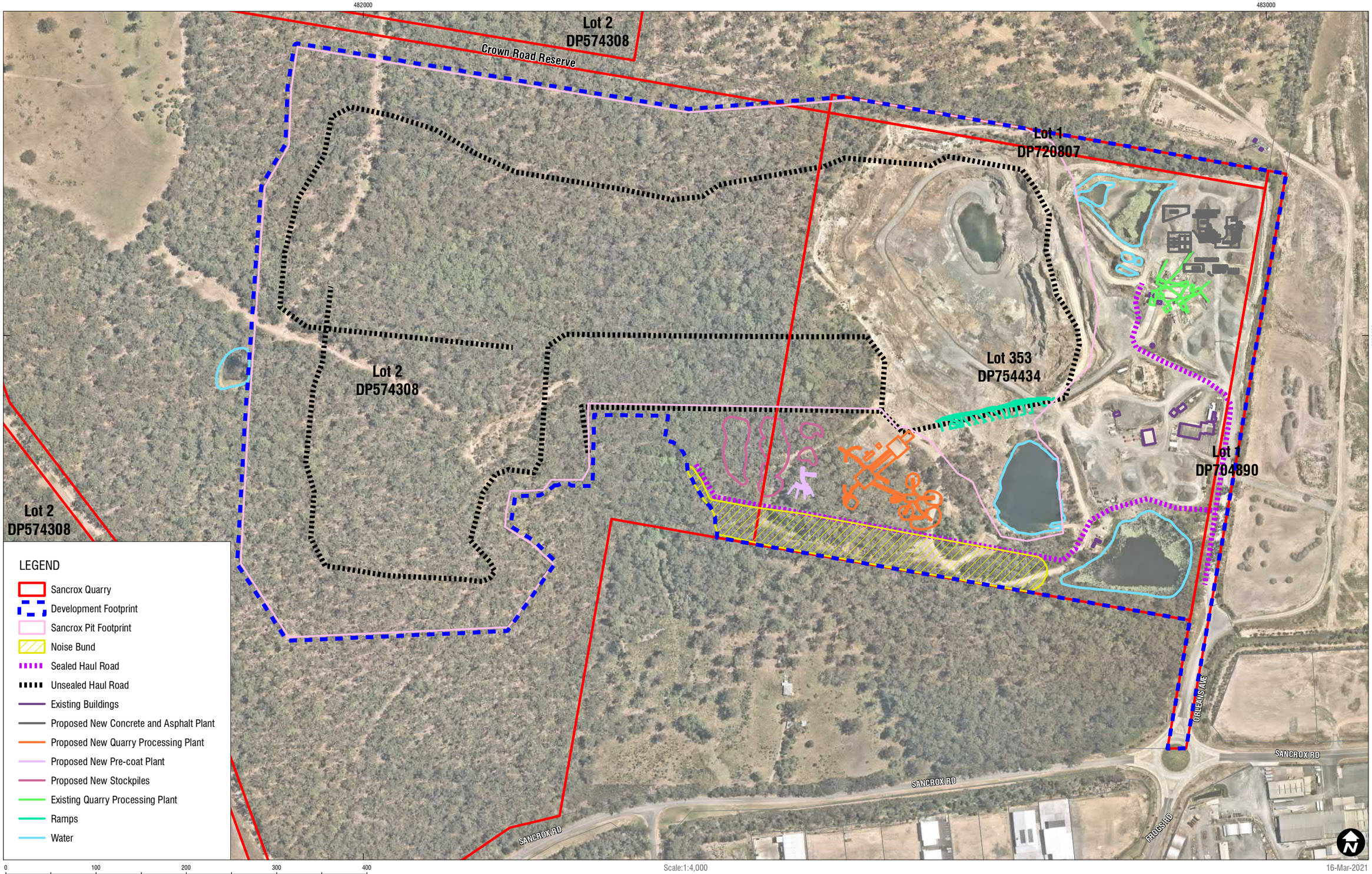
SEARs	Location in BAR
Key Issue – Biodiversity to include:	
Accurate predictions of any vegetation clearing on site.	Chapters 5 and 6

SEARs	Location in BAR
a detailed assessment of the likely biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems, and having regard to the *NSW Biodiversity Offsets Policy for Major Projects* and the *Framework for Biodiversity Assessment.*	Chapters 5 and 6
A strategy to offset any residual impacts of the development in accordance with the *NSW Biodiversity Offsets Policy for Major Projects*, including evidence that the appropriate type and quantum of offsets be available.	Chapter 7
OEH requirements (SEARs letter, Attachment B)	
The EIS is to include relevant local planning undertaken by the Port Macquarie – Hastings Council for the Greater Sancrox Area, in the context of the landscape to assess existing, and future habitat connectivity, especially in regards to alignment of subregional corridors, and local habitat linkages in accordance with s4.2.1.3(d) of the BAM.	Section 2.8
The species listed below as 1(a) and (b) are to be included, as part of the 'potential' serious and irreversible impacts, on other threatened entities as part of s10.2.1.5 of the *Biodiversity Assessment Method 2017* (BAM), not listed in the *Guidance and criteria to assist the decision maker to determine a serious and irreversible.* Should one of these entities be identified during survey, the proponent is required to provide additional information in accordance with section 10.2 of the BAM • *Dendrobium melaleucaphilum*- Spider Orchid • *Phaius australis* - Southern Swamp Orchid	Chapters 4 to 6

Consideration of the *Environment Protection & Biodiversity Conservation Act 1999* (EPBC Act) is also provided (see **Section 8**). Matters of National Environmental Significance (MNES) are protected under the EPBC Act and the FBA requires proponents to identify and assess the impacts on all nationally listed threatened species and threatened ecological communities that may be on the development site. Other MNES are not considered by the FBA.

The aims of the Report are as follows:

- Address the requirements of the SEARs;
- Address the requirements of the FBA;
- Describe the existing flora and fauna and other diversity values of the development site;
- Identify threatened biota of potential relevance to the site;
- Describe and quantify impacts on biodiversity values in accordance with the FBA; and
- Identify suitable measures to avoid, minimise and offset impacts on biodiversity associated with the Project.



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Data Source: NSW SS 2020
Aerial imagery supplied by Nearmap (November, 2020)

Aerial Image of the Development Site

Figure 3

1.5 Information Sources

The key information sources utilised in the assessment include:

- the *OEH Atlas of NSW Wildlife* for previous records of threatened species from the locality;
- the Protected Matters Search Tool, located on the Department of the Environment website (DE 2014b) for matters of national environment significance (as listed under the EPBC Act) predicted to occur within the locality;
- the *Threatened Species Profile Database*, for detailed information on threatened species of relevance to the site and the locality;
- GIS data on Interim Biogeographic Regionalisation for Australia (IBRA) regions and Mitchell Landscapes;
- the BioBanking Credit Calculator, for lists of predicted ecosystem credit species and species credit species and for the Project credit requirements;
- regional vegetation mapping, including GIS data that was utilised to prepare base vegetation maps and design field surveys;
- data collected during field surveys; and
- officers of the Office of Environment and Heritage (OEH), NSW Offsets Policy Team who provided assistance on particular matters relating to the FBA and the Credit Calculator.

Key documents that were reviewed and applied to inform this BAR include:

- Greater Sancrox Structure Plan 2014-2034 (PMHC 2015);
- Greater Sancrox Ecological Assessment (Biolink 2011); and
- Vegetation of the Port Macquarie Hastings LGA (Biolink 2013).

Other references and published literature are listed in the References section.

1.6 Methods Summary

This BAR was prepared according to the steps and processes detailed in the FBA, with the key steps being:

- Desktop review – database searches to identify listed threatened biota (species, populations and communities) of potential relevance to the study area; initial GIS mapping; survey design;
- Field survey of the study area (see **Appendix B** for details);
- GIS mapping and data compilation;
- Using GIS and field survey results to complete the 'landscape assessment';
- Identification of vegetation zones and use of BioBanking plot/transect data and GIS mapping to assess 'site value';
- Applying the proposed development footprint in GIS to calculate vegetation removal;
- application of the Credit Calculator, including identification of candidate threatened species and impact credit calculations; and
- Preparation of the BAR and BOS.

Appendix B provides details of the field surveys, including methods, survey effort and weather conditions. The field surveys conducted as part of this BAR are as follows:

- Targeted orchid survey on the 16 October 2015, timed to coincide with the known flowering period of the threatened orchid *Dendrobium melaleucaphilum*; details regarding the survey methods and results for the targeted orchid survey are provided in **Section 6.4**;
- five-day, four-night survey for threatened fauna species conducted by two SLR ecologists from 30 November to 4 December 2015;
- two-day survey by two SLR ecologists to conduct plot/transect surveys according to the BioBanking methodology set out in the FBA; and
- a one-night one day survey conducted by one SLR ecologist between 14 and 15 December 2015, to address minimum recommended survey effort (when combined with the five-day four-night survey) for a selection of threatened species previously recorded in the locality.

The purpose of the field surveys was to inspect the areas proposed for development and to collect the necessary floristic and habitat details for completion of the FBA assessment (including plot and transect data for site value score and targeted threatened species surveys). The survey design, including the location, number and set out of plot/transects, was completed according to the FBA. Copies of plot/transect field sheets are provided in **Appendix C**.

Application of the BioBanking Credit Calculator was completed by Jeremy Pepper, Principal Ecologist, accredited under s.142B(1)(c) of the *Threatened Species Conservation Act 1995* (TSC Act) (assessor #0107).

Additionally, as part of the Response to Submissions (RTS) on the EIS, SLR were engaged to conduct supplementary targeted surveys for the Koala in October 2020. The methods and results of the survey are summarised in the discussion of candidate species credit species in **Section 4.4.**

1.7 SLR Project Team – Staff Qualifications

The roles and qualifications of all staff responsible for preparation of this report are listed in **Table 2**.

Table 2 Staff Roles and Qualifications

Staff Name	Project Role	Qualifications
Jeremy Pepper	Project Manager Threatened orchid surveys FBA field work (plot/transects) Report co-author Credit Calculations Accredited BioBanking Assessor	Bachelor of Science (Hons Class 1) University of NSW 1996 Certificate II Bushland Regeneration, TAFE NSW Cert III Horticulture (Arboriculture), TAFE NSW BioBanking accredited assessor (#0107)
Gary Leonard	Flora and vegetation survey FBA plots/transects Plant identification Reporting	Masters of Science (in progress) Diploma of Education National Diploma of Horticulture Horticulture Certificate
Matt Doherty	Report drafting and research	Bachelor of Environmental Science and Management, University of Newcastle 2016

Staff Name	Project Role	Qualifications
Matt Consterdine	Ecologist Threatened species surveys Reporting	Bachelor of Environmental Science & Management, University of Newcastle, 2011
Louise Hibbert	CAD/GIS Draftsperson	Dip Architectural Technology, 2007 Cert IV Civil Construction Design, 2012
Stacy Mail	Threatened species surveys	Bachelor of Engineering (Civil) Diploma of Land Management

1.8 Definitions

Definitions used in this report are listed in **Table 3**.

Table 3 Common definitions and abbreviations used in the BAR

Term	Definition
BC Act	NSW *Biodiversity Conservation Act 2016*
Development Site	The area proposed for the quarry expansion and associated infrastructure and ancillary works, as shown in **Figure 3**
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
Locality	All land within 10 kilometres (km) of the Development Site.
Study Area	Area of land containing the Development Site and surrounding land that was subject to field surveys and desktop review
Threatened biota	Any threatened species, population or ecological community listed under the schedules of the BC Act (or former TSC Act). Threatened species and ecological communities listed under the EPBC Act.
TSC Act	NSW *Threatened Species Conservation Act 1995* (now repealed)
Matter of NES	Matter of national environmental significance listed under the EPBC Act
TEC	Threatened ecological community listed under BC Act, TSC Act and/or EPBC Act
EEC	Endangered ecological community listed under BC Act, TSC Act and/or EPBC Act

2 Landscape Features

This chapter describes the landscape features of the study area and surrounds, in accordance with Section 4 of the FBA.

2.1 Overview

Relevant landscape features pertaining to the study area have been identified according to Chapter 4 of the FBA, including:

- IBRA regions and subregions;
- Mitchell landscapes;
- Native vegetation extent and any 'cleared areas' (noting any differences between mapped vegetation and aerial imagery);
- Rivers and streams; and
- Wetlands.

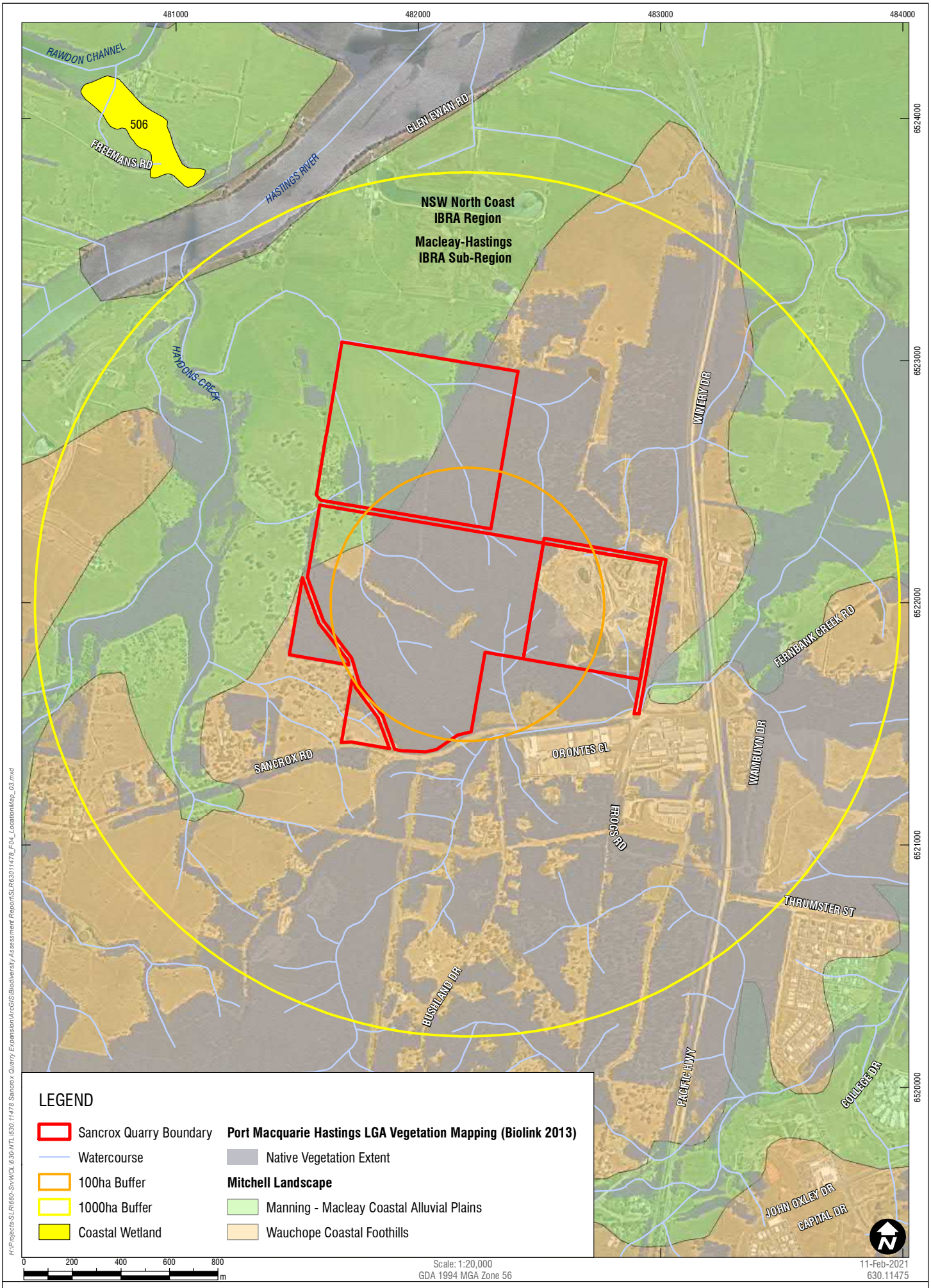
Relevant landscape features within the inner and outer assessment circles are displayed in the Site Map (**Figure 2**) and Location Map (**Figure 4**), as per Section 4 of the FBA.

No landscape features are specifically identified in the SEARs, although the SEARs (OEH) refer to existing and future habitat connectivity, biodiversity linkages and corridors, in the context of local planning undertaken by Port Macquarie Hastings Council. In this regard, biodiversity corridors and the Greater Sancrox Structure Plan are both discussed in **Section 2.8**.

Relevant landscape features are described in the following sections.

2.2 IBRA Bioregions and Subregions

The study area lies in the middle of the North Coast bioregion. The North Coast bioregion is adjacent to the New England Tablelands and Nandewar bioregions to the west and the Sydney Basin bioregion to the south (OEH 2016). The North Coast Bioregion lies on the east coast of New South Wales (NSW), with a small portion just inside the Queensland border, and covers an area of approximately 5,924,130 hectares, 96 % of which lies in NSW (IBRA). The North Coast Bioregion extends from Nelson Bay just north of Newcastle subregion north to Tweed Heads. Within its boundaries lie the towns of Maitland, Forster, Taree, Murrurundi, Port Macquarie, Kempsey, Coffs Harbour, Yamba, Grafton, Ballina, Byron Bay and Tweed Heads. The bioregion contains the Tweed, Richmond, Clarence, Coffs Harbour, Bellinger, Nambucca, Macleay, Hastings and Manning River catchments (OEH 2011).



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Data Source: NSW SS 2020
Aerial imagery supplied by Nearmap (November, 2020)

Location Map

FIGURE 4

The study area lies within Macleay-Hastings IBRA subregion, which is characterised by Silurian and Devonian slates, Carboniferous mudstones and Permian sandstones and shales. Soils are mainly red-brown structured loams on basalt; however there are a range of other, poorly known soils that relate to the subregions geology. Vegetation comprises of wet sclerophyll forest with White Mahogany, Small-fruited Grey Gum, Sydney Blue Gum, Blackbutt, Tallowwood and Brush Box. The open flat areas of the subregion are dominated by White Gum, Blackbutt, Forest Red Gum and Grey Box, while the coastal areas contain banksia, paperbark, Smooth-barked Apple and Blackbutt. The Barrington areas has a dense covering of Antarctic Beech and the Comboyne Plateau area has mixed patches of cool temperate and warm temperate rainforests. Stands of these main vegetation types are present within vegetation communities of the study area.

2.3 Mitchell Landscapes

The study area lies within two Mitchell landscapes:

- Manning - Macleay Coastal Alluvial Plains, which covers the north-western corner of the Development Site in Lot 2 south (DP 574308) as well as the western half of the proposed offset site in Lot 2 north (DP 574308).
- Wauchope Coastal Foothills, which occur throughout the majority of the Development Site in Lot 2 south (DP 574308), excluding the small portion in the north-west, as well as the eastern half of the proposed offset site in Lot 2 north (DP 574308).

The distribution of Mitchell Landscapes across the study area is shown in the Location Map (**Figure 4)**.

Manning-Macleay Coastal Alluvial Plains are described by DECCW (2002) as “Wide valleys, channels, floodplains, swamps and terraces of the Manning and Macleay rivers and other coastal streams on Quaternary alluvium with a general elevation of 0 to 50 m and a local relief of 15 m. Soils are described as dark, organic loams and silty clay on the floodplains, gradational brown loams and yellow yellow-brown texture contrast soil on terraces with organic silty mud in swamps.” The Manning - Macleay Coastal Alluvial Plains landscape is 57 % cleared.

Wauchope Coastal Foothills are described by DECCW (2002) as “hills and ranges of the coastal fall with some dendritic drainage on faulted carboniferous lithic sandstone, tuff and some limestone with a general elevation of 50 m to 460 m and a local relief of 200 m. Soils are described as having a red and yellow texture contrast throughout the area.” Common native plant species are Blackbutt, White Mahogany, Spotted Gum, Forest Red Gum, Grey Gum and Red Bloodwood (DECCW, 2002). The Wauchope Coastal Foothills landscape is 44 % cleared. As the Mitchell landscape occupying the majority of the Development Site, the percentage cleared value for Wauchope Coastal Foothills was applied to calculate the patch size score, in accordance with Appendix 4 of the FBA.

2.4 Soils

The study area has been mapped by NSW Office of Environment and Heritage (OEH) as Australian Soil Classification (ASC) type Kurosol. Kurosols are soils that have a strong texture contrast between the topsoil and subsoil horizons and contain strongly acidic subsoil and have moderate to moderately low inherent fertility. There are three Soil Landscape Units within the study area: Kundabung, Euroka and Cooperabung.

The study area has been assessed by OEH as Land and Soil Capability Classes 5 and 6 (OEH, 2012)

- Class 5 Moderately Low Capability Land: high limitations for high-impact agricultural land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
- Class 6 Low Capability Land: very high limitations for high-impact agricultural land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.

2.5 Native Vegetation extent

The extent of native vegetation within the study area and within the locality has been obtained using broad scale vegetation mapping data for the Port Macquarie-Hastings LGA (Phillips *et al.* 2013). The extent of native vegetation within the outer assessment circle, by vegetation class, is listed in **Table 4**

Around 45 % (447 ha) of the outer assessment circle comprises native vegetation, with the remaining 55 % (550 ha) comprising either cleared land or land that has not been mapped or assigned to a vegetation type.

Table 4 Native vegetation extent (by class) within outer (1,000 ha) circle

Class	Sum of Area	Proportion (%)
Estuarine seagrass	1.31	0
Coastal Floodplain Wetlands	58.57	13
Coastal Swamp Forests	45.51	10
Hunter - Macleay Dry Sclerophyll Forests	11.88	3
Mangrove Swamps	0.43	0
North Coast Dry Sclerophyll Forests	324.00	72
North Coast Wet Sclerophyll Forests	0.58	0
Northern Hinterland Wet Sclerophyll Forests	6.27	1
Unassigned	4.18	1
Grand Total	**452.73**	**100**
Total Native Vegetation Extent (1000 ha)	447.25	99

Conversely, areas not mapped as native vegetation, including 'cleared areas' and exotic vegetation, within the outer assessment circle account for 552.75 ha. Cleared areas within the Sancrox locality include:

- Built up areas and industrial land uses around the Sancrox industrial estate, immediately south of the site;
- Cleared farmland; and
- Infrastructure, including the Pacific Highway, and local roads, Main Northern Rail Line and the open water of the major rivers and streams (notably Hastings River, just west and north of the site).

2.6 Topography

A review of topographical mapping indicates that the highest elevation of the Development Site is 62 m and the lowest elevation is 4 m, giving a local relief of 58 m. The high point of the site occurs a small rounded knoll immediately west of the existing quarry pit and slopes steeply to the west and north, then gradually becomes a gentle slope towards the western and northern boundaries of the site. The slopes in the southern direction are steep and varied as there are several high areas in the southern part of the site.

There is a second area of high elevation, around 34 m, in the southern parts of the proposed Development Site, which has been identified as an area of disturbed land that can be described as an open valley. In the southern parts of the subject site there is another high point, at 40 m, which has steep slopes towards the east, west, north and south. This area is outside of the proposed Development Site. Contour intervals vary between 4 m and 62 m throughout the site and are closely spaced within the Development Site.

2.7 Waterbodies

2.7.1 Rivers and Streams

The Development Site lies within the catchment of the Hastings River, which flows towards the coast in a north-easterly direction beyond the northern boundary of the Development Site (**Figure 4**). At its closest point, the river flows approximately 2 kilometres to the north-east of the site.

There are no notable surface water bodies or tributaries within the study area. The nearest waterway, Haydons Creek, which is a fifth order stream, flows approximately 1.5 kilometres to the west of the study area boundary at its closest point. Haydon Creek is fed by small first order tributaries which are located in the southern parts of the Development Site (**Figure 2**). There are two first order streams in the northern part of the Development Site in Lot 2 DP 577308. These two streams feed into second order stream that flows through the proposed offset site and join to make a third order stream in the north-east of the site. This third order stream then flows west into Haydons Creeks. Haydons Creek then continues to flow north into the Hastings River.

As a fifth order stream, Haydons Creek is defined in the FBA as a "regionally significant biodiversity link", to which a 20 m riparian buffer applies. At its closest point this buffer will be approximately 1.2 kilometres from the site boundary.

The Hastings River is categorised as a seventh order stream, which is defined in the FBA as a "State significant biodiversity link", to which a 50 m riparian buffer applies. At its closest point, the Development Site will be approximately 1.3 kilometres from the riparian buffer zone of the Hastings River. (It is worth noting that the boundary of the Hastings River riparian buffer zone at its closest point is adjacent to the boundary of the proposed offset site – see **Section 7**).

There is evidence that a drainage line runs north-south through the site, feeding into a small stream that runs east from the site boundary.

2.7.2 Wetlands and estuarine areas

There are two water bodies within the study area. These two water bodies have been identified as small ponds of water created by areas of the quarry filling with rainwater and water from the drainage line on the site. There are no significant wetlands and estuarine areas on the subject site and an EPBC Act protected matters search revealed that there are no RAMSAR wetlands within 10 kilometres of the subject site.

The nearest wetlands, as identified by the Port Macquarie Hastings LGA Vegetation Mapping (Biolink 2013), are shown to occur approximately 2.45 kilometres to the north-west of the development site on the west bank of the Hastings River. The wetland is not a protected wetland under the RAMSAR convention.

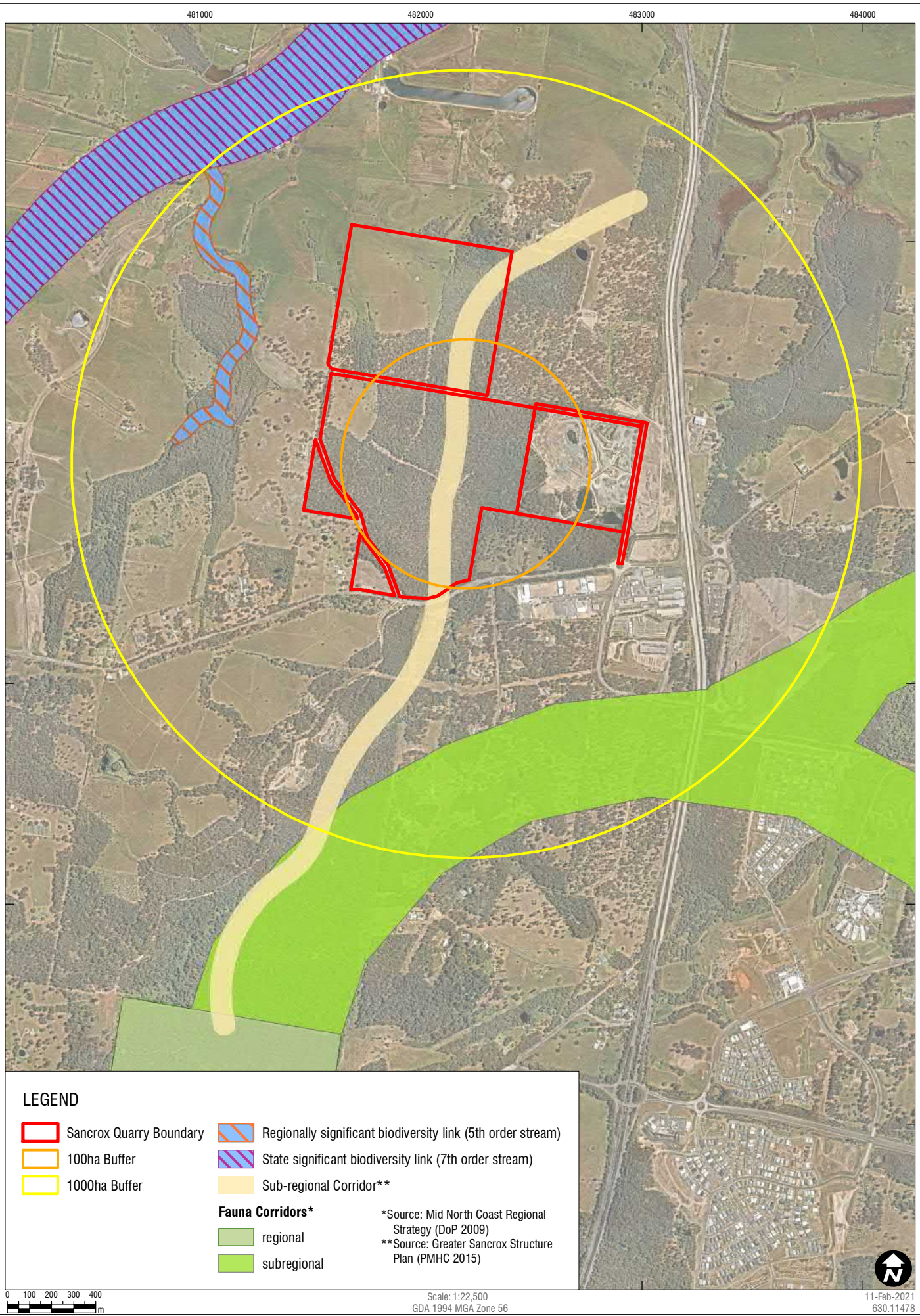
2.8 Biodiversity corridors and links

Published GIS data on State, regional and local biodiversity corridors links was obtained and reviewed as part of the preparation of this BAR. The key biodiversity corridors and links mapped within or near to the study area are mapped in **Figure 5** and include:

- a portion of a "sub-regional biodiversity corridor" mapped in the Greater Sancrox Structure Plan (see **Appendix D**), which traverses south-north through the centre of the Development Site. The corridor extends several kilometres south of the site; to the north of the site, it extends through the proposed offset site and before turning east and ending abruptly near the Pacific Highway; and
- a portion of a sub-regional "fauna corridor", mapped in the Mid North Coast Strategy, traverses just south of the Development Site before turning east. This corridor transforms into a "regional biodiversity corridor" further south of the Development Site. The subregional fauna corridor is approximately 1.5 kilometres from the Development Site.

The Mid-North Coast Regional Strategy (DOP 2009) states that fauna habitat corridors are of "high conservation importance" and as such urban development near these corridors should be limited.

In addition, the *Urban Growth Management Strategy 2017-2036* (PMHC 2017) classifies the area as a 'medium biodiversity asset/constraint' and identifies that the site could provide a 'major conceptual habitat link'. The strategy states the areas categorised as medium contain biodiversity assets that have the potential to be offset using the appropriate planning measures. The strategy maps **"**high priority koala habitat" within and surrounding the study area and there is a small portion of "medium-high priority biodiversity area" within the proposed Development Site. A large portion of the offset site has also been identified as 'key habitat' in the Strategy.



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Data Source: NSW SS 2020
Aerial imagery supplied by Nearmap (November, 2020)

Biodiversity Corridors

FIGURE 5

2.9 Landscape Value

Landscape value score was calculated according to Chapter 4 of the FBA. A 100 ha inner assessment circle was drawn in GIS, with the centroid on the Development Site using available aerial imagery as a base. Using a 1:10 ratio, a 1,000 ha outer assessment circle was also drawn. The inner and outer assessment circles are plotted in the Location Map (**Figure 4**).

2.9.1 Native Woody Vegetation cover

Native vegetation extent was mapped and the area calculated within the inner (100 ha) and outer (1,000 ha) landscape assessment circles using regional vegetation mapping of the Port Macquarie-Hastings LGA (Phillips *et al.* 2013). The extent of native vegetation within the landscape assessment circles is shown in **Figure 4**. The existing native vegetation cover within both assessment circles is listed in **Table 5**. Native vegetation comprises around 84 % of the inner assessment circle and 45 % of the outer assessment circle. These existing vegetation cover scores correspond to the cover classes of 81-85 % for the inner circle and 41-45 % for the outer circle.

Table 5 Percent vegetation cover in the landscape

Circle Size (ha)	Existing Veg. Cover (ha %)	Future Veg. Cover (ha %)
100	84.48 ha (84 %)	45.01 ha (45 %)
1000	452.74 ha (45 %)	413.27 ha (41 %)

The future extent of native vegetation cover within the inner and outer assessment circles was calculated by deducting the vegetation that would be removed as part of the proposed development (ie 39.02 ha) from the existing extent of native vegetation. Approximately 45.01 ha (45 %) native vegetation will remain within the inner assessment circle after clearing for the proposed development and around 413.27 ha (41 %) of native vegetation will remain in the outer assessment circle after development (**Table 5**). These future vegetation cover scores correspond to the cover class of 41-45 % in the Credit Calculator for both the inner circle and outer circle.

Based on the above results, the score for percentage native vegetation cover in the Credit Calculator is 2.95.

2.9.2 Connectivity

No State or regional biodiversity links occur within the Development Site, as discussed in **Section 2.8**. A 'site based assessment of connectivity' is therefore required, according to the approach set out in Appendix 4 of the FBA.

Connectivity score was calculated according to the method outlined in Appendix 4 of FBA. Using aerial imagery, connecting links of contiguous canopy vegetation across the study area were mapped. Inspection of aerial imagery reveals that two main links traverse the site, with native forest vegetation extending from south of the site through to north of the site. Beyond the northern boundary of the site, both links narrow to just one or two trees amongst cleared agricultural landscapes. However, within the site the linkages are wide, with a 'limiting width' at the narrowest point of over 100 m. The linkage width class for primary link before development was therefore assigned to > 100 m – 500- m wide. Removal of the native canopy vegetation as part of the quarry expansion within these theoretical links would render the future linkage width class to > 30 m to 100 m. Hence the number of linkage width classes crossed as a result of the impact of the proposed development is one.

The condition of vegetation within the vegetated link is assessed as likely to be within benchmark values for the respective plant community types. Hence linkage condition class (of woody vegetation) within the over-storey (canopy) and mid-storey or groundcover is estimated to be within benchmark before and after the proposed development (ie 'PFC at BM' and 'PFC of mid-storey/ groundcover at BM' chosen in the Credit Calculator). Hence no linkage condition classes are crossed (i.e. no change in linkage condition class).

The resulting score for connectivity in the Credit Calculator is 2.0.

2.9.3 Patch Size

Patch size of native woody vegetation was estimated using GIS and available spatial data for vegetation of the Port Macquarie-Hastings LGA by Phillips *et al.* (2013). The native woody vegetation in moderate to good condition on the site extends off the site to surrounding areas forming a large patch that is estimated to be 1255 ha (see **Figure 4**).

The percentage cleared value for Wauchope Coastal Foothills Mitchell landscape, which occupies the majority of the Development Site (see **Figure 4**), is 54 %. The 'patch size class' for a Mitchell landscape with a percentage cleared value of 30-70% and a patch size of > 200 ha is categorised as 'Extra-large' and attracts a patch size score of 12.

2.9.4 Landscape Value Score

Landscape value is calculated in the Credit Calculator based on the sum of the three landscape assessment components in the FBA: (i) native vegetation extent (ii) connectivity score and (iii) patch size. For the Sancrox SSD project the landscape score in the Credit Calculator is composed of the following scores:

- Native vegetation extent - 2.95;
- Connectivity score – 2.0; and
- Patch size score – 12,

giving an overall landscape value score of 17.

3 Native Vegetation

This chapter describes the native vegetation on the study area in accordance with Section 5 of the FBA.

3.1 Study Area Characteristics

The study area is a mosaic of forested areas, low-lying swampy terrain, cleared grazing land and areas of disturbance and infrastructure. The study area incorporates the existing quarry, with surrounding areas of cleared and disturbed terrain, open water in detention dams, roads and the buildings and infrastructure of the quarry administration centre. West of the existing pit, where the quarry expansion is proposed, lies a tract of bushland that extends over an elevated hill rising to 62 m above sea level. Further west, open grassland is interspersed with scattered trees across low lying terrain that drains to the northwest. Several hundred metres further northwest lies the Hastings River, which eventually drains to the coast at Port Macquarie several kilometres east of the study area. The cleared grassy areas in the western parts of the study area are used for cattle grazing.

Similarly in the northwestern parts of the study area (including the northern parts of Lot 2, which is proposed to set aside as a biodiversity offset) the land has been cleared and supports cattle grazing over grasslands. Adjoining these cleared grassy areas to the east are stands of swamp forest and paperbark swamp forest. Further details on the nature and condition of the proposed offset site are provided in **Section 7**.

3.2 Regional (Broad-scale) Vegetation Mapping

The following regional vegetation mapping resources are available for the study area and were reviewed as part of the preparation of this BAR:

- Vegetation of the Port Macquarie-Hastings LGA (Phillips *et al.* 2013);
- Mapping of the Northern Rivers catchment (NRCMA 2011); and
- 'CRAFTI' data prepared as part of the Comprehensive Regional Assessments (CRA) (NPWS 2012).

The Council data (Phillips *et al.* 2013), being smaller scale than the other data sets, was found to be the most accurate and precise when viewed at the scale of the study area. Accordingly, the Council mapping was adopted as a 'base map' to guide the field survey design, and was verified and, where necessary, modified during field surveys. An excerpt of the Council mapping for the study area is provided in **Table 6**.

The Council vegetation types mapped within the Development Footprint are shown in **Figure 6** and their mapped extents (in hectares) are listed in **Table 6**.

Table 6 Regional vegetation mapping within the study area[#]

Code	Council Vegetation Type	Area (ha)
PMVC_035	Spotted Gum Grassy Dry Forest	11.08
PMVC_037	White Stringybark - Tallowwood - Grey Gum Dry Forest	27.94
	Total:	**39.02**

Source: Phillips *et al.* 2013.

Profiles for each of the three vegetation types listed in are provided in **Appendix E**. A brief description of each is provided below:

3.2.1 Spotted Gum Grassy Dry Forest

This community is described as "A tall to extremely tall open forest dominated by Spotted Gum *Corymbia citriodora* [sic]. Common associates include Grey Ironbark *Eucalyptus siderophloia*, Broad-leaved White Mahogany *Eucalyptus carnea*, Tallowwood *Eucalyptus microcorys* and Grey Gum *Eucalyptus propinqua* with scattered Pink Bloodwood *Corymbia intermedia*, White Stringybark *Eucalyptus globoidea* and the occasional Blackbutt *Eucalyptus pilularis*" (Phillips *et al*. 2013). The community is restricted to the Cooperabung and Beechwood erosional soil landscapes at Red Hill and Sancrox.

Spotted Gum Grassy Dry Forest is mapped by Council through the central parts of the site, to the west of the existing pit, and with a small disjunct patch within the area adjacent to the east of the pit (see **Figure 6**).

3.2.2 White Stringybark – Tallowwood – Grey Gum Dry Forest

White Stringybark – Tallowwood – Grey Gum Dry Forest is described as "A tall to very tall open forest dominated by White Stringybark *Eucalyptus globoidea* growing in association with Tallowwood *Eucalyptus microcorys*. Common associates include Broad-leaved White Mahogany *Eucalyptus carnea*, which occurs occasionally as a sub-dominant, Grey Gum *Eucalyptus propinqua* and Turpentine *Syncarpia glomulifera*, less commonly Red Bloodwood *Corymbia gummifera* and Grey Ironbark *Eucalyptus siderophloia*" (Phillips *et al*. 2013). The community occurs in the NSW coastal hinterland between Sancrox and Heron's Creek.

The majority of the vegetation across the site is mapped as White Stringybark – Tallowwood – Grey Gum Dry Forest, occurring over much of the land west of the existing pit, extending to the western limits of (and beyond) the proposed development footprint, as well as narrow bands around the existing dam in the southeastern corner of the site (see **Figure 6**).

3.3 Vegetation Classes

According to broad-scale mapping of Port Macquarie-Hastings LGA (Phillips *et al.* 2013), the vegetation within the Development Footprint comprises two vegetation classes occurring within two vegetation formations, as listed in **Table 7**. Vegetation classes are described below.

Table 7 Vegetation Formations and Classes Mapped in the Study Area

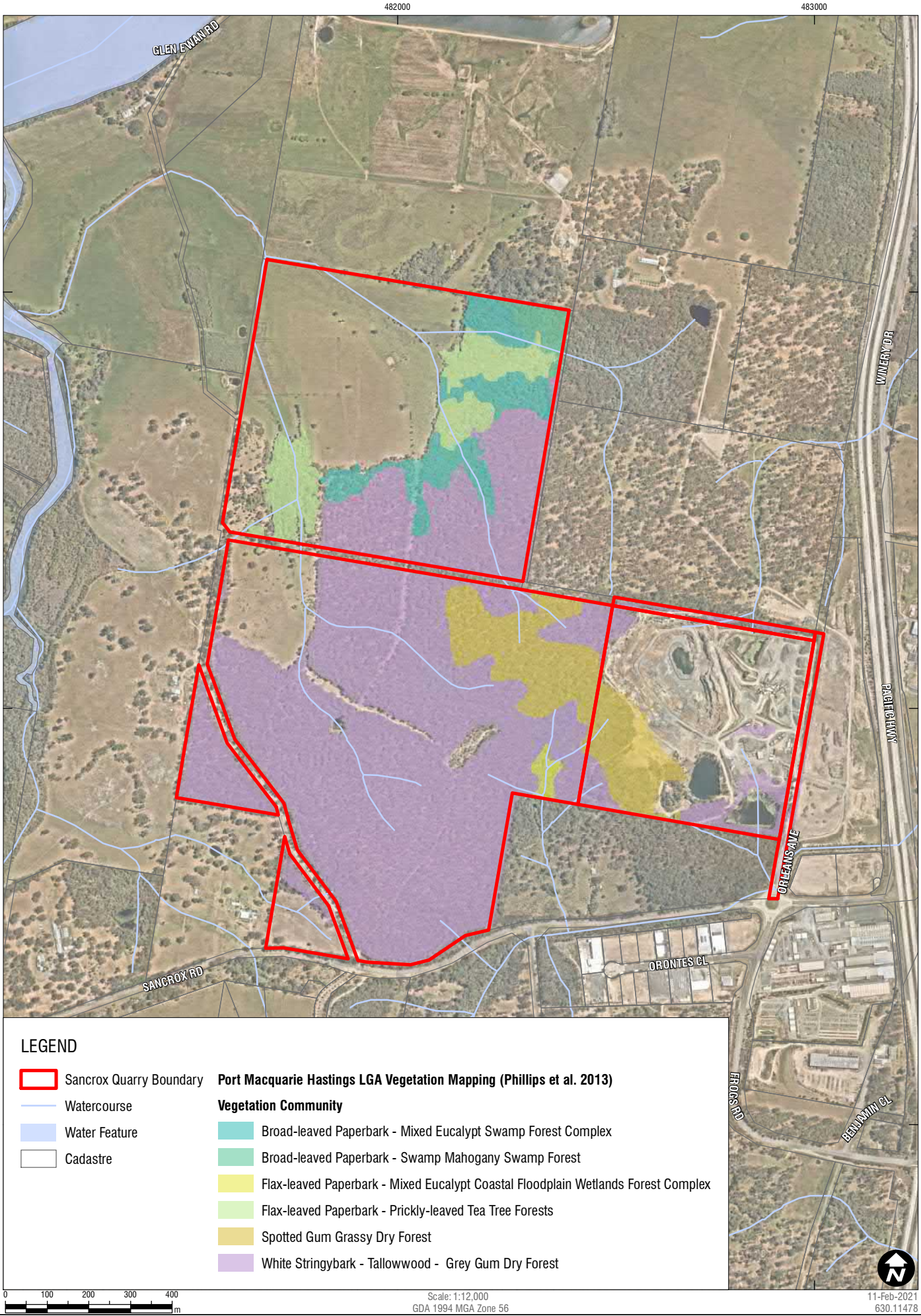
Vegetation Formation	Vegetation Class	Area (ha)
Dry Sclerophyll Forests (shrub/grass)	Hunter-Macleay Dry Sclerophyll Forests	11.08
Wet Sclerophyll Forests (Grassy sub-formation)	Northern Hinterland Wet Sclerophyll Forests	27.94
	Total	**39.02**

Hunter-Macleay Dry Sclerophyll Forests

Hunter-Macleay Dry Sclerophyll Forests are dry open eucalypt forest to 30 m tall, with a mixed sclerophyll and mesophyll shrub stratum and semi-continuous grassy groundcover. This vegetation class is dominated by large Eucalypt species including *Corymbia maculata* (spotted gum), *Eucalyptus crebra* (narrow-leaved ironbark), *E. moluccana* (grey box), *E. propinqua* (grey gum), *E. siderophloia* (grey ironbark) and *Syncarpia glomulifera* (turpentine). Hunter-Macleay Dry Sclerophyll Forests may also have *Angophora costata* (Sydney red gum) and *Eucalyptus punctata* (grey gum) though these species are mainly identified in the eastern Hunter valley. The community is associated with foothills and undulating terrain in rain shadow valleys below 400 m elevation in the eastern parts of coastal rainshadow valleys, well-drained loams derived from shales and foothills and undulating terrain below 400 m on loamy soils derived from shales. They are associated with the major coastal river valleys along the New South Wales coast, and occur in local areas that are transitional between Coastal Valley Grassy Woodlands and Northern Hinterland Wet Sclerophyll Forests. They are associated with the major coastal river valleys along the New South Wales coast, and occur in local areas that are transitional between Coastal Valley Grassy Woodlands and Northern Hinterland Wet Sclerophyll Forests. This vegetation class varies floristically in response to latitude and the influence of clay content within the soil (OEH, 2017b).

Northern Hinterland Wet Sclerophyll Forests

Northern Hinterland Wet Sclerophyll Forests are tall, open dry eucalypt forests to 40 m tall with a mix of sclerophyllous and monophyllous shrub stratum with a continuous grassy ground cover. The canopy of the vegetation class is dominated by *Eucalyptus microcorys* (tallowwood), *E. pilularis* (blackbutt), *E. propinqua* (grey gum), *E. siderophloia* (grey ironbark), *Syncarpia glomulifera* (turpentine). Minor occurrences or localised dominance of *Angophora subvelutina* (broad-leaved apple), *Corymbia intermedia* (pink bloodwood) and *Eucalyptus carnea* (thick-leaved mahogany) may also feature. The vegetation class is associated with the fertile soils of derived siltstone and metasediments on the upper slopes and ridges of coastal foothills and plateaux below 600m within areas where the mean annual rainfall exceeds 1,000mm. Its range extends along the northern New South Wales coastal areas north of the Sydney region through into South-east Queensland however, most dominate within the Coffs Harbour and Port Macquarie districts. The vegetation class is known to have an extensive, variable and diverse floristics that can be similar to that of North Coast Wet Sclerophyll Forest, which can co-occur in more sheltered and mesic parts of the landscape. A simplified grassy understorey can occur when extensively burnt and grazed.



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Data Source: NSW SS 2020
Aerial imagery supplied by Nearmap (November, 2020)

Regional Vegetation Mapping for Port Macquarie-Hastings LGA

FIGURE 6

3.4 Plant Community Types (PCTs)

3.4.1 Overview

Plant community types (PCTs) were mapped across the study area during the field survey, using vegetation mapping of the Port Macquarie-Hastings LGA (Phillips *et al.* 2013) as a base map. The following broad vegetation types mapped within the study area, as noted in **Section 3.2**, were recorded within the site:

- Spotted Gum Grassy Dry Forest; and
- White Stringybark - Tallowwood - Grey Gum Dry Forest.

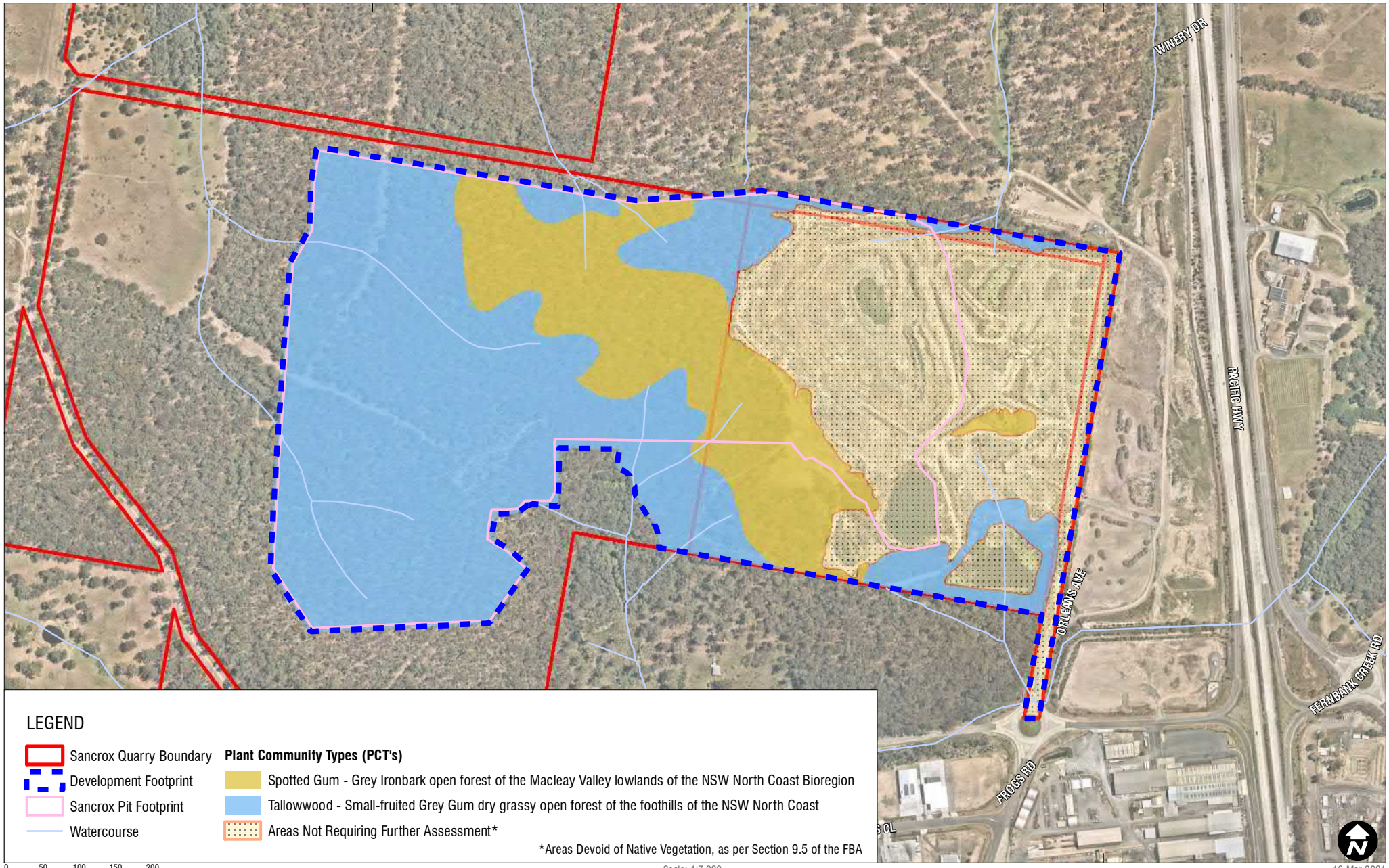
Using the online NSW BioNet Vegetation Classification database, these communities were converted into PCTs, as per **Table 8**.

Table 8 Conversion of Council mapping units to PCTs

Council Vegetation Type#	PCT	PCT Name
Spotted Gum Grassy Dry Forest	1215	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
White Stringybark - Tallowwood - Grey Gum Dry Forest	1262	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

Source: Phillips *et al.* 2013

The PCTs mapped within the Development Footprint are listed in **Table 9**. The distribution of these plant community types within the study area is shown in **Figure 7**. The floristics and structure of these communities, as they occur on the site, is described below. Profiles of each PCT obtained from the BioNet Vegetation database are provided in **Appendix F.**



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Data Source: NSW SS 2020
Aerial imagery supplied by Nearmap (November, 2020)

Plant Community Types Mapped Within the Development Site

FIGURE 7

Table 9 Plant Community Types (PCTs) mapped within the development footprint

PCT Code	PCT Name*	TEC	% Cleared [2]	Area (ha)
1215	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	No	35 %	11.08
1262	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	30 %	27.94
	Total Native Vegetation			**39.02**

Table 10 lists the vegetation formation and vegetation class associated with each PCT mapped within the study area.

Table 10 Formations, Classes and PCTs mapped within the development footprint

Vegetation Formation	Vegetation Class	PCT Name	Area (ha)
Dry Sclerophyll Forests	Hunter - Macleay Dry Sclerophyll Forests	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	11.08
Wet Sclerophyll Forests	Northern Hinterland Wet Sclerophyll Forests	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	27.94
		Total Native Vegetation	**39.02**

One of the PCTs recorded within the study area, PCT 686, represents an example of the threatened ecological community *Subtropical coastal floodplain forest of the NSW North Coast bioregion*, which is listed as endangered on the BC Act. However, through amendments to the proposed pit layout (ie 'avoidance measures'), this vegetation will not be directly affected by the proposed development and will remain *in situ*. Threatened ecological communities are discussed further at **Section 3.7**.

3.4.2 Spotted Gum-Grey Ironbark Open Forest (PCT 1215)

Location:

This vegetation type occurs across the middle of the subject site on upper slopes, to the west of the quarry, in sandy well-drained soils.

Area: 11.08 ha.

Structure:

A tall open-forest with mostly grassy groundcover.

Trees from 15 to 25 m. FPC 15 to 35 %.

Shrubs and small trees from 2 to 12 m; FPC generally to 15 % to 35 % in some patches.

Groundcover 0.1 to 0.5 m. FPC up to 60%.

Floristics:

Trees:

- *Corymbia maculata* (Spotted Gum)
- *Eucalyptus acmenoides* (White Mahogany)
- *Eucalyptus siderophloia* (Northern Grey Ironbark)
- *Lophostemon confertus* (Brushbox)

Small Trees and Shrubs:

- *Allocasuarina torulosa* (Forest Oak)
- *Allocasuarina littoralis* (Black Oak)
- *Acacia melanoxylon* (Blackwood)
- *Acacia implexa* (Hickory)

Vines and Groundcovers:

- *Themeda triandra* (Kangaroo Grass)
- *Imperata cylindrica* var. *major* (Blady Grass)
- *Lomandra longifolia* (Spiny-headed Mat-rush)
- *Billardiera scandens* (Apple Berry)
- *Glycine* spp. (Love Creeper)

A total of 35 indigenous species and no exotic species were recorded in the BioBanking plot. The canopy species include: *Eucalyptus siderophloia* (5), *Corymbia maculata* (4), *Corymbia intermedia* (3) and *Eucalyptus globoidea* (3). Common mid-storey species include *Allocasuarina torulosa*, *Polyscias sambucifolia* and *Breynia oblongifolia*. Common groundcover species include *Themeda triandra*, *Entolasia marginata*, *Lomandra hystrix* and *Dichelachne micrantha*.

This plant community type does not constitute a TEC under the BC Act or EPBC Act.

3.4.3 Tallowwood – Small fruited Grey Gum dry grassy open forest (PCT 1262)

Location:

This vegetation type occurs across a large proportion of the subject site, especially in the western parts. This vegetation occurs mostly on coastal foothills.

Area: 27.94 ha

Structure:

An open-forest with mostly grassy groundcover.

Trees from 12 to 20 m. FPC 15 to 30%.

Small trees and shrubs from 2 to 12 m; FPC generally to 10%.

Groundcover 0.1 to 1 m; FPC up to 70%.

Floristics:

Trees:

- *Eucalyptus globoidea* (White Stringybark)
- *Eucalyptus microcorys* (Tallowwood)
- *Eucalyptus siderophloia* (Northern Grey Ironbark)
- *Eucalyptus propinqua* (Small-fruited Grey Gum)
- *Syncarpia glomulifera* subsp. *glomulifera* (Turpentine)

Small Trees and Shrubs:

- *Allocasuarina torulosa* (Forest Oak)
- *Allocasuarina littoralis* (Black Oak)
- *Persoonia linearis* (Narrow-leaved Geebung)
- *Dodonaea triquetra* (Hop-bush)

Vines and Groundcovers:

- *Themeda triandra* (Kangaroo Grass)
- *Imperata cylindrica* var. *major* (Blady Grass)
- *Lomandra longifolia* (Spiny-headed Mat-rush)
- *Pteridium esculentum* (Bracken Fern)
- *Hardenbergia violacea* (Purple Coral Pea).

A total of 32 indigenous species and one exotic species (several specimens of *Cinnamomum camphora*) were recorded. The canopy species include *Eucalyptus siderophloia* (3), *Corymbia gummifera* (3) and *Eucalyptus globoidea* (3). Common mid-storey species include *Allocasuarina littoralis*, *Melaleuca linariifolia*, *Callistemon salignus*, *Alphitonia excelsa* and *Glochidion ferdinandi* var. *ferdinandi*. Common groundcover species include *Imperata cylindrica* var. *major*, *Carex appressa*, *Centella asiatica*, *Microlaena stipoides* var. *stipoides* and *Dichondra repens.*

This plant community type does not constitute a TEC under the BC Act or EPBC Act.

3.5 Site Specific Vegetation Mapping – Differences to Regional Mapping

Vegetation types and vegetation mapping as described by Phillips *et al.* (2013) were adapted in the initial desk-top assessment and then validated by field work. For the purposes of this assessment, the vegetation descriptions used by Phillips *et al.* (2013) were then converted to the nearest approximation of descriptions of the NSW Plant Community Types that are stated to occur within the Northern Rivers Catchment Management Area (CMA).

3.5.1 Biometric vegetation classification

The NSW Plant Community Type classification was developed in 2011 "…to establish an unambiguous master community-level classification for use in vegetation mapping programs, regulatory decisions, and as a standard typology for other planning and data gathering programs…." In 2011 the PCT classification consolidated two existing community-level classifications:

1. The NSW Vegetation Classification and Assessment database (Benson 2006 & 2008; Benson *et al.* 2006 & 2010);
2. The Biometric Vegetation Types database used in NSW regulatory processes including property vegetation planning, Bio-certification and BioBanking.

Since 2011, several quantitatively derived regional classification data sets have been into the PCT classification.

3.5.2 Mapping of Port Macquarie-Hastings LGA

Phillips *et al.* (2013) state that "…Vegetation mapping was undertaken in two stages and involved polygon capture down to a minimum patch size of 0.25 ha (0.1 ha for littoral rainforest) using task-specific software and a combination of satellite, aerial and digital imagery. Excluding National Park and State Forest estate, approximately 115,922 ha of remnant vegetation was captured for purposes of the mapping project. Once captured, polygons were internally partitioned by hand. Field survey involved a combination of formal 0.04 ha floristic plots sampled in accord with Modules 1 and 2 of the NSW Government's Native Vegetation Type Standard. Less detailed but similarly quantitative "rapid" assessments were also undertaken in other areas, supported by foot-, vehicle- and air-based traverses for ground-truthing purposes. Available data from other studies was (sic) also employed to assist the mapping process…..Disregarding geographical constraints, approximately 70% of the mapped vegetation communities conform to those similarly recognised by the NSW Northern Rivers Catchment Management Area's Vegetation Classification System, the remainder constituting novel ecological entities for the Northern Rivers CMA that have hitherto not been detailed…..".

The vegetation mapping prepared by SLR for this report differs only slightly from the regional-scale mapping by Phillips *et al.* (2013), in the context of locations and extent of vegetation types.

The vegetation type that has the greatest spatial representation over the site is mapped by Phillips *et al.* (2013) as White Stringybark–Tallowwood–Grey Gum Dry Forest. The structural and floristic characteristics of the surveyed patches of vegetation validated this description. This vegetation type was matched with the Plant Community Type Tallowwood - Small-fruited Grey Gum dry grassy open forest (PCT 1262) and was found, after data analysis, to comply with the description of the PCT.

The vegetation is mapped as Spotted Gum Grassy Forest by Phillips *et al.* (2013) and is a distinctive plant community within the Port Macquarie-Hastings LGA and is only conserved at Bundjalung National Park, within the North Coast region (see Griffith 1993; Hager and Benson 1994). The Plant Community Type Spotted Gum Grey Ironbark open forest (PCT 1215) is the most appropriate classification for the vegetation recorded on the subject site.

With due consideration to the above listed factors, SLR has modified the regional vegetation mapping for the study area and has mapped native vegetation patches, where present, to create a site specific vegetation map for the study area (see **Figure 7)**. The PCTs recorded and mapped within the study area are described in **Section 3.4**.

3.6 Vegetation Zones

According to the FBA (OEH 2014), vegetation zones are areas of vegetation of the same type and same condition class. Vegetation zones are categorised into either 'low' or 'moderate to good' condition. To qualify as low condition the native vegetation (being woody vegetation) within a vegetation zone must have:

- a value of less than 25 % of the lower benchmark value in the canopy; and
- groundcover that is either less than 50 % indigenous (or native) or over 90 % cleared.

PCTs mapped within the study area have been further divided into the following vegetation zones:

- Veg Zone 2 - NR247_Moderate/Good Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion;
- Veg Zone 3 - NR263_Moderate/Good Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast;
- Veg Zone 4 - NR263_Moderate/Good_Poor Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast; and
- Veg Zone 5 - NR247_Moderate/Good_Poor Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion.

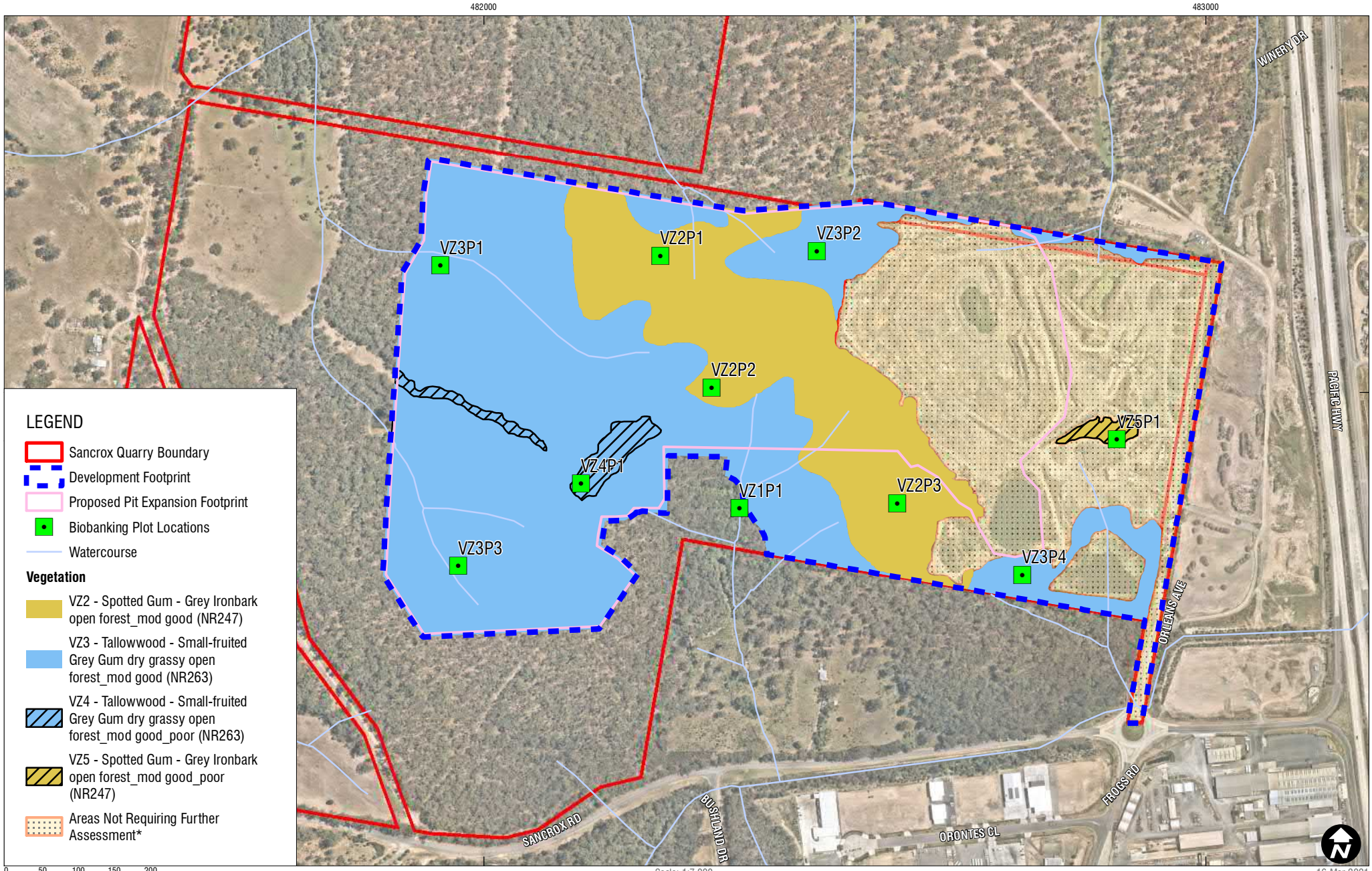
We note that vegetation zone 1 (Veg Zone 1 - NR117_Moderate/Good Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion) formerly existed within the development footprint but has been removed from consideration due to amendments to the pit layout to avoid this vegetation type.

The distribution of these vegetation zones within the development site, as well as the location of plot/transects, is shown in **Figure 8**. The vegetation zones, their mapped extent within the study area and plots completed within each zone are listed in **Table 11**.

Table 11 Vegetation Zones mapped within the Development Site

No.	Vegetation Zone name	Vegetation type name	Area (ha)	Min plots#	Plots done
2	NR247_Moderate/Good	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	10.83	3	3
3	NR263_Moderate/Good	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	27.10	4	4
4	NR263_Moderate/Good_Poor	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	0.84	1	1
5	NR247_Moderate/Good_Poor	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	0.25	1	1
		Total	**39.02**	**9**	**9**

Minimum number of plots required in the FBA.



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*Areas Devoid of Native Vegetation, as per Section 9.5 of the FBA

Data Source: NSW SS 2020
Aerial imagery supplied by Nearmap (November, 2020)

Vegetation Zones and Plot Locations

FIGURE 8

3.7 Threatened Ecological Communities

3.7.1 Desktop Results

According to the NSW Wildlife Atlas (10 km search), nine threatened ecological communities (TECs) have been recorded within the locality, including;

- Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions
- Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion
- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion
- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
- Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales 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.

Of the above listed communities, one was recorded within the study area: Subtropical coastal floodplain forest. However, this threatened community does not lie within the development site. No evidence for any other threatened ecological communities was recorded within the Development Site.

With reference to the above TECs:

- There is no estuarine habitat within the study area; hence no saltmarsh vegetation;
- There are no stands of rainforest vegetation within the study area;
- The detention ponds or dams that lie within the active quarry site, in the southeastern corner of the Development Site, are not natural wetlands and do not support the requisite flora assemblages that characterise the Freshwater Wetlands on Coastal Floodplains TEC;
- There are no stands of Swamp Oak on floodplain or estuarine margins;
- There are stands of Swamp Mahogany swamp forest and paperbark swamp forest in the proposed offset site, as discussed in **Section 7**; however no such vegetation occurs within the Development Site; and
- The site is located at some distance from the coast; hence there are no seacliffs or headlands that could support the Themeda grassland on seacliffs and coastal headlands TEC.

3.7.2 Subtropical coastal floodplain forest

A small patch of Blackbutt–Pink Bloodwood Shrubby Open-forest (PCT 686) lies beyond the southern boundary of the site and represents an example of the threatened ecological community *Subtropical coastal floodplain forest of the NSW North Coast bioregion*, which is listed as endangered under Schedule 1 (Part 3) the BC Act. This community is not listed under the EPBC Act. The community does not occur within the Development Site and therefore is not considered further in this BAR.

4 Threatened Species

This chapter describes the threatened species predicted to occur within the study area, based on the field survey results, the outputs of desktop assessment and the outputs of the BioBanking Credit Calculator, in accordance with Section 6 of the FBA.

4.1 Overview

Several sources of information have been employed to create a list of candidate threatened species and populations relevant to the study area. The Credit Calculator outputs of ecosystem credit species and species credit species are used as the basis for the consideration of threatened species in this BAR. In addition to this, the NSW Wildlife Atlas 10 km search tool was used to search for previous records of threatened species (as listed under the *Biodiversity Conservation Act 2016* - BC Act) from the locality.

Overall, an assemblage of 81 threatened species or populations are deemed as potential relevance to the study area. This assemblage consists of 14 plants, 35 birds, 24 mammals, four amphibians, three reptiles and one endangered population. The habitat requirements and ecology of the threatened species predicted to occur within the study area are described in the likelihood of occurrence table presented in **Appendix G** this report. The likelihood of occurrence rating is based on the results of field surveys, and particularly on the extent, nature and condition of habitat types and habitat features within the study area.

Of the 81 threatened biota potentially relevant to the site at Sancrox, seven were recorded within the study area during the current field surveys (see **Figure 9**). These species and the field survey results are discussed in **Sections 4.3** and **4.4**.

Additionally, the SEARs identify the following threatened species as requiring "further consideration":

- Biconvex Paperbark *Melaleuca biconvexa*;
- Spider Orchid *Dendrobium melaleucaphilum*; and
- Southern Swamp Orchid *Phaius australis*.

These species were not recorded during the current investigation, despite targeted searches for the two orchid species during their known flowering periods. These species are discussed further in **Section 6.4**.

This chapter describes the threatened species of potential relevance to the site and hence that were targeted during field surveys, in terms of (i) ecosystem credits (**Section 4.3**) and (ii) species credits (**Section 4.4**).

4.2 Summary of Threatened Species Recorded on Site

Threatened species recorded on the Development Site, including their respective habitat components and credit type, are listed in **Table 12**.

Table 12 Threatened species recorded on the site

Species	BC Act	Credit Type	Habitat Component Development Site
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	Vulnerable	Ecosystem (foraging habitat) Species (breeding)	Foraging habitat available on site. Roosting habitat and breeding caves absent. Recorded on site via AnaBat Detector.
Eastern False Pipistrelle *Falsistrellus tasmaniensis*	Vulnerable	Ecosystem	Foraging and roosting habitat available. Recorded on site (AnaBat detector).
Eastern Freetail-bat *Mormopterus norfolkensis*	Vulnerable	Ecosystem	Foraging and roosting habitat available. Recorded on site (AnaBat detector).
Greater Broad-nosed Bat *Scoteanax rueppellii*	Vulnerable	Ecosystem	Foraging and roosting habitat available. Recorded on site (AnaBat detector)
Grey-headed Flying-fox *Pteropus poliocephalus*	Vulnerable	Ecosystem (foraging habitat) Species (breeding)	Foraging habitat available on site. No breeding habitat, including camp sites, on or near site. Recorded via visual observation and call recognition.
Koala *Phascolarctos cinereus*	Vulnerable	Species	Koala feed trees present within forested parts of site (within all PCTs mapped on site)
Little Bent-wing Bat *Miniopterus australis*	Vulnerable	Ecosystem (foraging habitat) Species (breeding)	Foraging habitat available on site. Roosting habitat and breeding caves absent. Recorded on site via AnaBat Detector.

A total of seven threatened fauna species were recorded on the site at Sancrox during the survey (31st November to 14th December 2015) including:

- six microchiropteran bats;
- the Koala; and
- one megachiropteran bat (Grey-headed Flying Fox).

A number of threatened microchiropteran bat species, listed under the BC Act, were recorded via ultrasonic detection (using AnaBat recorders), namely the Eastern Falsistrelle, Little Bent-wing Bat, Greater Broad-nosed Bat, East-coast Freetail Bat and Yellow-bellied Sheathtail-bat (possible ID), Eastern Bent-wing Bat (Probable ID). No microchiropteran bats were recorded in harp traps.

Individuals of the Grey-headed Flying-fox, which is listed under both the BC Act and the EPBC Act, were recorded during spotlighting surveys. However, no flying-fox camps (or other evidence of breeding or roosting) were recorded on the site.

Although limited evidence (via sightings or aural calls) for the Koala was recorded on the site during the original surveys (in 2015), recent findings from targeted surveys conducted for the Koala in October 2020 indicate the presence of this species on the site. Further details are provided in **Section 4.4**.

No threatened ground mammals (including Rufous Bettong, Spotted-tailed Quoll, Eastern Chestnut Mouse, and Common Planigale) were recorded via the use of cage trapping, Elliot trapping, camera monitoring or spotlighting.

No threatened arboreal mammals (other than the Koala, and including Squirrel Glider, Yellow-bellied Glider or Brush-tailed Phascogale) were recorded via glider-tube trapping, arboreal hair tube trapping or spotlighting.

No threatened amphibians were recorded during spotlighting or call playback at waterbodies in the bushland or within the quarry. All waterbodies on the site contain Mosquito Fish *Gambusia holbrooki*, which are a tadpole predator and would further decrease the likelihood of any threatened amphibians occurring.

The only reptiles observed were the Lace Monitor and Eastern Water Dragon. There are no threatened reptiles known to occur in the locality.

No threatened woodland birds or raptors were observed during avifauna surveys. No threatened forest owls were observed during spotlighting or call-playback surveys.

The following sections detail the threatened species of relevance to the Development Site, in terms of ecosystem credit species and species credit species.

4.3 Ecosystem Credit Species

According to the FBA, threatened species that attract ecosystem credits are predicted to occur in a given area based on the presence of "habitat surrogates"[1]. Where such habitat surrogates occur, these species have a "high likelihood of being present on the site" and therefore a threatened species survey is not required.

By contrast, targeted surveys are required for species that attract species credits, as discussed in **Section 4.4**.

4.3.1 Generated by credit calculator

A total of 25 ecosystem credit species have been predicted to occur within the study area according to the Credit Calculator (**Table 13**). Species prediction is based on the presence of certain habitat surrogates, including vegetation zones that have been mapped within the study area and on landscape values. According to Section 6.3 of the FBA, an ecosystem credit species is deemed as 'on site' if one or more of its habitat components are present on site. The three habitat components used for this assessment include foraging habitat, breeding habitat and roost/shelter habitat.

Table 13 lists the ecosystem credit species predicted to occur within the Development Footprint (including records from field surveys) and provides reasoning for the predicted presence or absence of the species within the study area (including habitat component). Species recorded on site are listed in bold type.

[1] IBRA subregion, PCT, percent vegetation cover and vegetation condition.

Table 13 Threatened species predicted to occur by the Credit Calculator (ecosystem credit species)

Species	BC Act	LoO*	On Site **	Habitat Component Development Site
Barking Owl *Ninox connivens*	Vulnerable	M	Yes	Foraging habitat available. Large hollow nesting habitat scarce. No records within of site (Atlas of NSW Wildlife)
Barred Cuckoo-shrike *Coracina lineata*	Vulnerable	M	Yes	Potential foraging and nesting habitat. No records within of site (Atlas of NSW Wildlife)
Brown Treecreeper *Climacteris picumnus victoriae*	Vulnerable	L	Yes	Potential foraging and nesting habitat availability, although prefers habitats inland of Great Dividing Range.
Bush Stone-curlew *Burhinus grallarius*	Endangered	L	Yes	Moderate habitat available on site, dense shrubs for nesting predominantly absent. No records within 10 km of site (Atlas of NSW Wildlife)
Diamond Firetail *Stagonopleura guttata*	Vulnerable	L	Yes	Foraging and nesting habitat available on site, dense shrubs for nesting predominantly absent. No records within 10 km of site (Atlas of NSW Wildlife)
Eastern False Pipistrelle ***Falsistrellus tasmaniensis***	**Vulnerable**	**P**	**Yes**	**Foraging and roosting habitat available, recorded on site (Anabat detector))**
Eastern Freetail-bat ***Mormopterus norfolkensis***	**Vulnerable**	**P**	**Yes**	**Foraging and roosting habitat available, recorded on site (Anabat detector)**
Glossy Black-Cockatoo *Calyptorhynchus lathami*	Vulnerable	L	Yes	Scattered foraging habitat available within pockets of *Allocasuarina* trees; Hollow-bearing trees for nesting are rare.
Greater Broad-nosed Bat ***Scoteanax rueppellii***	**Vulnerable**	**P**	**Yes**	**Foraging and roosting habitat available, recorded on site (Anabat detector)**
Hoary Wattled Bat *Chalinolobus nigrogriseus*	Vulnerable	H	Yes	Foraging and roosting habitat available.
Hooded Robin *Melanodryas cucullata cucullata*	Vulnerable	L	Yes	Potential foraging and nesting habitat although prefers structurally diverse forests or woodland. No records within of site (Atlas of NSW Wildlife)
Little Eagle *Hieraaetus morphnoides*	Vulnerable	M	Yes	Potential foraging and nesting habitat available on site; large home range.
Little Lorikeet *Glossopsitta pusilla*	Vulnerable	M	Yes	Potential foraging and nesting habitat on site. Large home range.
Long-nosed Potoroo *Potorous tridactylus*	Vulnerable	L	Yes	Foraging and breeding habitat availability, although dense understorey vegetation is predominantly absent on site.
Masked Owl *Tyto novaehollandiae*	Vulnerable	M	Yes	Foraging and breeding habitat available, although large hollow nesting habitat scarce, nearby records to site (within 2 km).

Species	BC Act	LoO*	On Site **	Habitat Component Development Site
Powerful Owl *Ninox strenua*	Vulnerable	L	Yes	Foraging and breeding habitat available, large hollow nesting habitat scarce, large home range.
Scarlet Robin *Petroica boodang*	Vulnerable	M	Yes	Potential foraging and nesting habitat available on site. Large home-ranges. No records within 10 km of site (Atlas of NSW Wildlife)
Spotted-tailed Quoll *Dasyurus maculatus*	Vulnerable	L	Yes	Potential foraging habitat availability, den opportunities scarce. Large home ranges
Square-tailed Kite *Lophoictinia isura*	Vulnerable	M	Yes	Foraging habitat availability in woodland areas; large home ranges. Low quality nesting habitat (preferred near to watercourses).
Swift Parrot *Lathamus discolour*	Endangered	L	Yes	Potential foraging habitat: winter flowering eucalypts (e.g. Spotted Gum) on site. Breed in Tasmania.
Varied Sittella *Daphoenositta chrysoptera*	Vulnerable	H	Yes	Foraging and nesting habitat available in woodland areas; nearby records to site (within 2 km).
Yellow-bellied Glider *Petaurus australis*	Vulnerable	L	Yes	Potential foraging habitat availability. Large hollow bearing trees scarce.
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*	**Vulnerable**	**H**	**Yes**	**Possible recording on site (AnaBat Detector). Data likely to be confused with calls with those of other bat species). Foraging habitat available, roosting habitat (hollow-bearing trees) scarce.**

* Likelihood of occurrence – see **Appendix G** for likelihood definitions.

** Species marked 'Yes' have been ticked as 'On site' in the Credit Calculator.

4.3.2 Wildlife Atlas (10 km search)

A range of other ecosystem credit threatened species has been identified in the 10 km search results from the NSW Wildlife Atlas. Although not identified as 'predicted threatened species' in the Credit Calculator, these species were targeted during surveys conducted in December 2015. **Table 14** provides the listings and survey findings for each species.

The relevance of each species to the proposal is based on their individual habitat requirements, which are provided in the Likelihood of Occurrence (LoO) table in **Appendix G** of this report. The process of assessing habitat for such species was undertaken in accordance with the steps in Section 6.3 of the FBA. Species recorded on site are listed in bold type.

Table 14 Additional Ecosystem Credit Species generated by Wildlife Atlas

Species	TSC	LoO**	Relevance
Blue-billed Duck *Oxyura australis*	Vulnerable	L	Moderate habitat availability in large quarry dams (in disturbed quarry area), prefers dense aquatic vegetation. No habitat in proposed expansion area.

Species	TSC	LoO**	Relevance
Common Blossom-bat *Syconycteris australis*	Vulnerable	L	Low habitat availability; prefers littoral rainforest for roosting and feeds in heath or paperbark swamps. Occasionally occurs in wet sclerophyll forests.
Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*	**Vulnerable**	**P**	**Foraging habitat available on site. Roosting habitat predominately absent. Breeding caves absent.**
Eastern Cave Bat *Vespadelus troughtoni*	Vulnerable	L	Foraging habitat available on site. Roosting and breeding habitat (caves) is absent.
Eastern Grass Owl *Tyto longimembris*	Vulnerable	L	Low habitat availability, prefers areas with tall grass, including tussocks, grassy plains, swampy areas or sedges on floodplains
Grey-headed Flying-fox *Pteropus poliocephalus*	**Vulnerable**	**P**	**Foraging habitat available on site.** **No breeding habitat, including camp sites, on or near site.**
Southern Myotis *Myotis macropus*	Vulnerable	M	Foraging habitat available on site particularly near larger waterbodies in quarry area. Roosting habitat such as caves, mine shafts or hollow-bearing trees is rare or absent.
Spotted Harrier *Circus assimilis*	Vulnerable	L	Habitat available on site, largely vagrant - unlikely to occur apart from possible foraging activity. Found most commonly in native grassland.
Rose-crowned Fruit-Dove *Ptilinopus regina*	Vulnerable	L	Low habitat availability, prefers rainforest and occasionally moist eucalypt forest; unlikely to occur.

* Based on 'probable' or 'possible' confidence level in identification of Anabat recordings. Some possibility of confusion of data with those of other bat species.

** Likelihood of occurrence – see Appendix G for likelihood definitions.

4.3.3 Predicted Ecosystem Credit Species

The relevant steps in Section 6 of the FBA have been applied to identify the ecosystem credit species present on the site, or which have a high likelihood of occurrence on the site. The likelihood of occurrence has been identified for all of the potential ecosystem credit species by conducting habitat and vegetation type assessments across the site. The results for this are provided in the likelihood of occurrence table in **Appendix G**. Furthermore, detailed ecological surveys for species with moderate or high likelihood of occurrence were undertaken on the site in December 2015.

A total of 25 threatened species (that attract ecosystem credits) have been predicted to occur within the site in the Credit Calculator. Of these, four threatened micro-bats were recorded during field surveys:

- Eastern False Pipistrelle;
- Eastern Freetail-bat;
- Greater Broad-nosed bat; and
- Yellow-bellied Sheathtail Bat;

Whilst not listed as 'predicted threatened species' in the Credit Calculator, an additional three threatened bats were recorded on site:

- Eastern Bentwing-bat;

- Little Bentwing-bat; and
- Grey-headed Flying-fox.

The Eastern False Pipistrelle, Eastern Freetail-bat, Greater Broad-nosed bat and Yellow-bellied Sheathtail Bat attract ecosystem credits; whereas the Eastern Bentwing-bat, Little Bentwing-bat and Grey-headed Flying Fox attract ecosystem credits for foraging habitat and species credits for impacts on their breeding habitat (see **Section 4.4**).

The ecosystem credit bat species recorded on the site are described below, including credit type (within Northern Rivers CMA), conservation status, habitat requirements and conservation biology. The locations of records within the study area (which are all linked to Anabat detector locations) are shown in **Figure 9**. Data on credit type and other ecology of each species is sourced from the Threatened Species Profile Database.

Eastern False Pipistrelle *Falsistrellus tasmaniensis*

Credit type: Ecosystem

NSW Status - Vulnerable (BC Act); Commonwealth status – not listed (EPBC Act)

The Eastern False Pipistrelle inhabits sclerophyll forests in south eastern Australia from southern Queensland to Tasmania with a preference for moist forest types and tall trees (>20m). It roosts predominantly in hollow-bearing trees although can use caves or buildings. Foraging distances can be large with one record of a 12 km commute from roost.

This species breeds during Spring months and young are usually born in December or January. Hibernation occurs during winter months. The best time of year for identification of this species is mid-spring to mid-autumn.

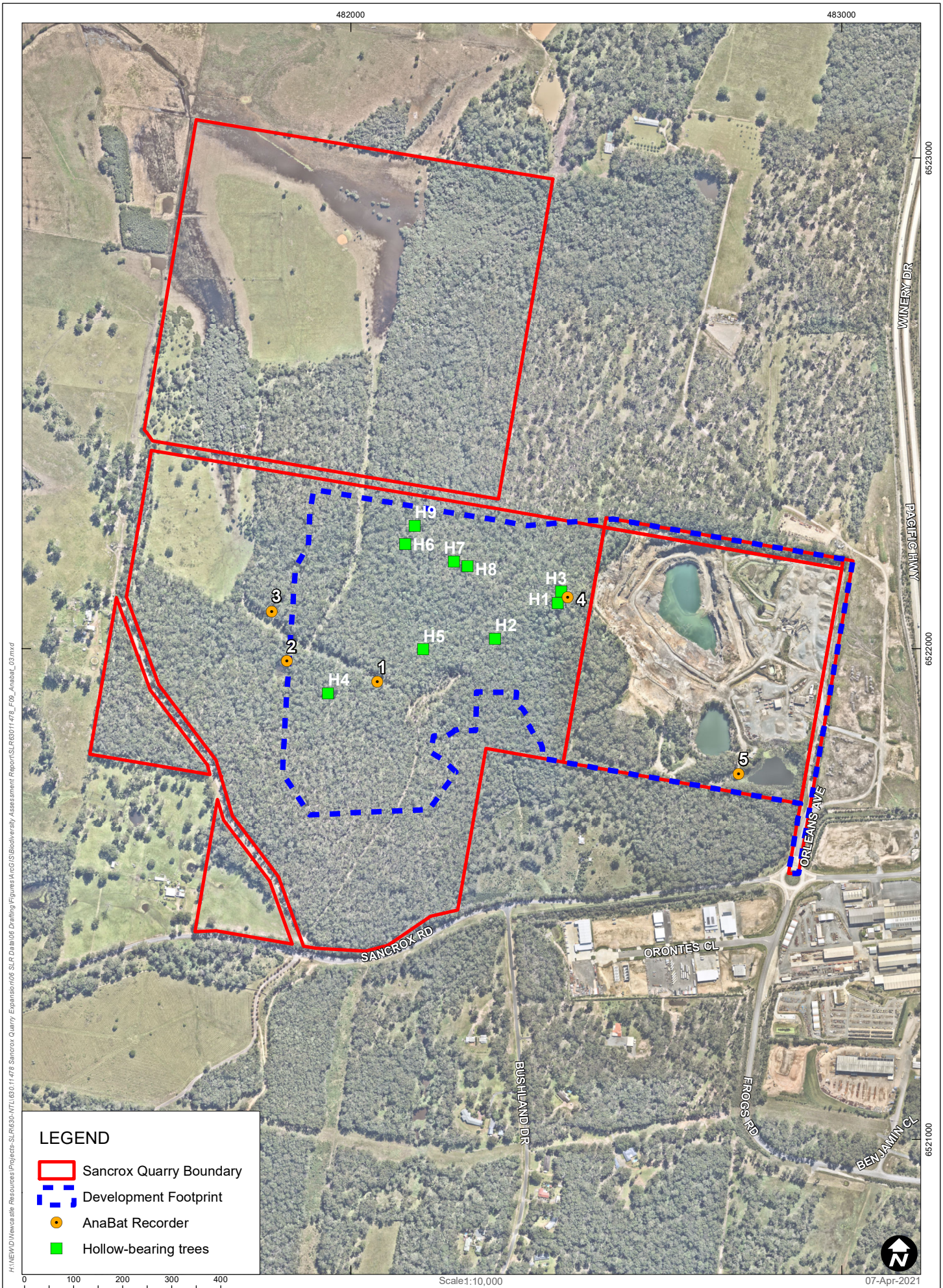
Within the Northern Rivers CMA, the Eastern False Pipistrelle can only tolerate up to 10 % loss of foraging habitat and up to 10 % loss of hollow-bearing trees.

Eastern Freetail-bat *Mormopterus norfolkensis*

Credit type: Ecosystem

NSW Status - Vulnerable (BC Act); Commonwealth status – not listed (EPBC Act)

The Eastern Freetail-bat is found dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. This species nests in hollow-bearing trees although will also roost under bark or in man-made structures. The site contains limited hollow-bearing trees that might provide roosting habitat for this species. Forest and woodland foraging habitat is abundant.



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Data Source: NSW SS 2020
Aerial imagery supplied by Nearmap (November, 2020)

Fauna survey locations, habitat trees and threatened bat records

FIGURE 9

Within the Northern Rivers CMA, the Eastern Freetail-bat can only tolerate temporary loss of up to 10 % foraging habitat and no more than 10 % hollow bearing trees.

Greater Broad-nosed Bat *Scoteanax rueppellii*

Credit type: Ecosystem

NSW Status - Vulnerable (BC Act); Commonwealth status – not listed (EPBC Act)

The Greater Broad-nosed Bat utilises habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Its distribution includes slopes of the Great-dividing range and coastal regions from north-eastern Victoria to the Atherton Tableland in Queensland. This species predominantly roosts in tree hollows, which are available on the site in small amounts. Woodland foraging habitat for this species is abundant on the site however preferred creek line and riparian vegetation is largely absent.

Within the Northern Rivers CMA, the Greater Broad-nosed Bat can only tolerate temporary loss of 10 % of foraging habitat and 10 % loss of hollow-bearing trees. Loss of riparian habitat cannot be tolerated.

Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*

Credit type: Ecosystem

NSW Status - Vulnerable (BC Act); Commonwealth status – not listed (EPBC Act)

The Yellow-bellied Sheathtail Bat was also recorded as a 'Possible Identification', meaning the calls recorded by Anabat are *likely* to be confused with calls with those of other bat species. The site does contain suitable foraging habitat for this species although roosting habitat such as hollow-bearing trees are scarce. This species is regarded as present and is included in the offset calculation for the proposal on the site.

This species occurs in many habitat types and occupies very large ranges. Like all microchiropteran bats, this species is most active in warmer months between October and March. It forages throughout most habitats over its large range, even in treeless areas. Individuals roosts in tree hollows and in treeless areas, and is also known to roost in mammal burrows. Breeding has been recorded from December to mid-March. Some of the hollow-bearing trees recorded within the site could provide roosting habitat for this species.

The Yellow-bellied Sheathtail-bat can only tolerate temporary loss of 10 % of foraging habitat and 10 % of hollow-bearing trees within the Northern Rivers CMA.

Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*

Credit types: Ecosystem (foraging habitat) and Species (land containing caves or similar structures)

NSW Status - Vulnerable (BC Act); Commonwealth status – not listed (EPBC Act)

The Eastern Bent-wing Bat is an ecosystem credit species that was not predicted to occur in the Credit Calculator but was recorded using AnaBat detectors (with 'Probable' confidence level) within the Development Site (see **Figure 9**). Probable confidence level means that the calls recorded by AnaBat have some possibility of confusion of calls with those of other bat species.

This species occurs in a variety of forest formations along the east and north-west coasts of Australia. Roosting occurs predominantly in caves and occasionally in derelict mines, storm-water tunnels, buildings and other man-made structures. Populations use maternity caves in spring and summer and during other months disperse up to 300 km from these caves.

Foraging habitat, in the form of forest, woodland and adjoining open areas, is present within the site. Roosting and breeding habitat (i.e. caves, disused mines shafts, some buildings) is absent from the site.

Within the Northern Rivers CMA, the Eastern Bentwing-bat attracts ecosystem credits for foraging habitat and species credits for breeding habitat (land containing caves or similar structures). As no caves or similar structures were recorded within the study area, no species credits are generated for the impacts of the development on the Eastern Bentwing-bat. Impacts on the Eastern Bentwing Bat as a result of the proposed development are therefore quantified via loss of foraging habitat represented as ecosystem credits.

Within the Northern Rivers CMA, the Eastern Bentwing-bat cannot tolerate loss of natural breeding or roosting habitat and can tolerate no more than 10 % loss of foraging habitat within 500 m of breeding habitat (caves in Karst). There can be no capping of loss of foraging habitat elsewhere.

Grey-headed Flying-fox *Pteropus poliocephalus*

Credit types: Ecosystem (foraging habitat) and Species (land within 40 m of rainforest, coastal scrub, riparian or estuarine communities)

NSW Status - Vulnerable (BC Act); Commonwealth status – Vulnerable (EPBC Act)

The Grey-headed Flying-fox is an ecosystem credit species that was not predicted to occur in the Credit Calculator but was recorded during field surveys within the Development Site. This species occurs in a variety of woodland formations including subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. There is no roosting camp on or adjacent to the site. The forest and woodland habitats that extend across the site provide foraging resources for this species during flowering season when individuals search for nectar and pollen in native trees, in particular *Eucalyptus, Melaleuca* and *Banksia*, and fruits of rainforest trees and vines.

Within the Northern Rivers CMA, the Grey-headed Flying-fox attracts ecosystem credits for foraging habitat and species credits for breeding and roosting habitat (i.e. “land within 40 m of rainforest, coastal scrub, riparian or estuarine communities”). The forested parts of the Development Site represent foraging habitat for Grey-headed Flying-fox and accordingly, impacts on the foraging habitat for this species have been included as ecosystem credits. However, the site does not contain or lie within 40 m of rainforest, coastal scrub, riparian or estuarine communities. Hence no species credits are generated for the impacts of the development on the Grey-headed Flying-fox.

Within the Northern Rivers CMA, the Grey-headed Flying-fox cannot sustain loss of breeding habitat. It can tolerate up to 10 % loss of foraging habitat providing that "replanting" or "supplementary planting" is undertaken in offset sites.

Little Bentwing-bat *Miniopterus australis*

Credit types: Ecosystem (foraging habitat) and Species (breeding/roosting habitat)

NSW Status - Vulnerable (BC Act); Commonwealth status – not listed (EPBC Act)

The Little Bentwing-bat was not listed as a predicted threatened species in the Credit Calculator, but was nonetheless recorded using ultrasonic call detection (i.e. AnaBat detector).

The Little Bentwing-bat inhabits moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub in south eastern Australia from Cape York in Queensland to Wollongong in New South Wales. This species often uses caves, abandoned mines or buildings as roosting habitat however does also utilise tree hollows which are available (although limited) on the site. Like the Eastern Bentwing-bat, this species uses maternity caves during summer months to rear young.

Within the Northern Rivers CMA, the Little Bentwing Bat attracts both ecosystem credits and species credits. Ecosystem credits are linked to foraging habitat, whilst species credits are only applicable where breeding habitat (i.e. caves) occurs.

Whilst foraging habitat is widespread across the site, maternity caves or other similar resources for breeding and roosting for Little Bentwing Bat are not present. For this reason, preparation of a species polygon (according to Section 6.5 of the FBA) and creation of species credits is not required for the Little Bentwing-bat.

Within the Northern Rivers CMA, the Little Bentwing-bat can only tolerate 5% loss of tree hollows, and up to 10% loss of foraging habitat. No loss of breeding habitat can be tolerated.

4.4 Species Credit Species

A total of 29 candidate 'species credit species' have been determined relevant to the study area according to the Credit Calculator. This predicted list of species is based, *inter alia*, on previous records and the 'Geographic/Habitat Features' identified in the Credit Calculator.

4.4.1 Assessment of Geographic / Habitat Features

Potential candidate species credit species have been identified in the Credit Calculator based on relevant geographic and/or habitat features that are present on site. As part of the revision of this BAR, all threatened species and their habitat and geographic requirements at this step in the Credit Calculator were reviewed and (where necessary) updated. The relevant species and their associated habitat features are listed in **Table 15**.

Table 15 Assessment of Geographic / Habitat Features for Species Credit Species

Impact?	Common Name	Scientific Name	Feature
✓	Biconvex Paperbark	*Melaleuca biconvexa*	Swamps, swamp margins or creek edges
✓	Giant Barred Frog	*Mixophyes iteratus*	Land below 1000 m in altitude and within 40 m of rainforest or eucalypt forest with deep leaf litter.
✓	Pale-headed Snake	*Hoplocephalus bitorquatus*	Land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber.

✓	Milky Silkpod	*Parsonsia dorrigoensis*	Subtropical or warm temperate rainforest or open eucalypt forest or ecotones between rainforest and eucalypt forest.
✓	North Brother Wattle	*Acacia courtil*	Shallow soils in dry open forest or rocky slopes.
✓	Common Planigale	*Planigale maculate*	Rainforest, eucalypt forest, healthland, marshland, grassland or rocky areas.
✓	Green-thighed Frog	*Litoria Brevipalmata*	Land within 100 m of semi-permanent or ephemeral ponds or depressions containing leaf litter.
✓	Willawarrin Doubletail	*Diuris disposita*	Grassy open forest

Other species credit species listed in the Credit Calculator under the Geographic/Habitat Features tab were not ticked as 'Impacted' (or relevant to the site) as their specific habitat requirements or geographic features are not present within the development site.

4.4.2 Candidate species – Generated by credit calculator

A total of 29 candidate 'species credit species' have been determined relevant to the project (**Table 16**). Species recorded on site during field surveys are listed in bold type.

Table 16 Species credit species – Credit Calculator output and field survey records

Species	BC Act	LoO*	On Site	Habitat present on site
Biconvex Paperbark *Melaleuca biconvexa*	Vulnerable	L	No	Potential habitat availability in low-lying areas containing paperbark in southern patch and in western area of site. Not recorded during surveys.
Brush-tailed Phascogale	*Phascogale tapoatafa*	M	No	Moderate potential habitat in woodland areas throughout site. Not recorded on site during fauna survey
Common Planigale *Planigale maculata*	Vulnerable	L	No	Potential habitat availability in woodland areas. Low occurrence of tree hollows may be a deterrent.
Eastern Chestnut Mouse *Pseudomys gracilicaudatus*	Vulnerable	L	No	Low habitat availability, prefers heathland mainly in dense, wet heath and swamps
Eastern Pygmy Possum *Cercartetus nanus*	Vulnerable	L	No	Possible habitat availability in woodland areas although lack of understorey and sparsity of trees may be a deterrent.
Giant Barred Frog *Mixophyes iteratus*	Endangered	L	No	Low habitat availability, prefers freshwater streams
Green-thighed frog *Litoria brevipalmata*	Vulnerable	L	No	Potential habitat availability in soaks and depressions on the site (following heavy rain). Can occur in drier sclerophyll forest (in disturbed quarry area).

Species	BC Act	LoO*	On Site	Habitat present on site
Groves Paperbark *Melaleuca groveana*	Vulnerable	L	No	Low habitat availability, prefers heath and shrub land, often in exposed sites, in low coastal hills, escarpment ranges and tablelands on outcropping granite, rhyolite and sandstone.
Koala *Phascolarctos cinereus*	**Vulnerable**	**M**	**Yes**	**Scats recorded in 2015. Scats and sighting of adult Koala during recent 2020 survey. Some areas modelled as 'high Koala activity'. Koala feed trees present on site.**
Leafless Tongue Orchid *Cryptostylis hunteriana*	Vulnerable	M	No	Marginal potential habitat occurs on site in very restricted locations in paperbark swamp forest margins.
Milky Silkpod *Parsonsia dorrigoensis*	Vulnerable	L	No	Low habitat availability, prefers subtropical and warm-temperature rainforest, on rainforest margins, and in moist eucalypt forest.
North Brother Wattle *Acacia courtii*	Vulnerable	L	No	Only found in the Laurieton district occurring on North Brother, Middle Brother and South Brother Mountains
Pale-headed Snake *Hoplocephalus bitorquatus*	Vulnerable	L	No	Possible habitat available. Low occurrence of tree hollows may be a deterrent.
Pale-vented Bush-hen	Vulnerable	L	No	No suitable habitat
Parma Wallaby	Vulnerable	L	No	Preferred habitat not available; prefers moist eucalypt forests and rainforest margins.
Rainforest Cassia *Senna acclinis*	Endangered	L	No	Low habitat availability, prefers margins of subtropical, littoral and dry rainforests.
Red-backed Button-quail *Turnix maculosus*	Vulnerable	L	No	Low habitat availability, prefers grasslands, heath and crops.
Regent Honeyeater *Anthochaera phrygia*	Critically Endangered	L	No	Low breeding habitat potential onsite due to small number of mature trees, open canopy, and lack of preferred woodland tree species. Possible foraging habitat in winter.
Rufous Bettong *Aepyprymnus rufescens*	Vulnerable	M	No	Potential habitat in woodland areas, native grasses in ground layer unlikely tall or dense enough for favourable habitat.
Rusty Plum *Niemeyera whitei*	Vulnerable	L	No	Low habitat availability, prefers gullies of warm temperate or littoral rainforests and the adjacent understorey of moist eucalypt forest.
Scant Pomaderris *Pomaderris queenslandica*	Endangered	L	No	Possible habitat availability, vegetation communities that occur on site are not typical species assemblages in which it is known to occur.
Slender Marsdenia *Marsdenia longiloba*	Endangered	L	No	Low habitat availability, prefers subtropical and warm temperate rainforest, lowland moist or open eucalypt forest adjoining rainforest and, sometimes, in areas with rock outcrops.

Species	BC Act	LoO*	On Site	Habitat present on site
Squirrel Glider *Petaurus norfolcensis*	Vulnerable	M	No	Potential habitat in woodland areas. Lack of understorey for foraging and tree hollows for shelter would likely be a deterrent.
Stephens Banded Snake *Hoplocephalus bitorquatus*	Vulnerable	L	No	Low habitat availability, prefers rainforest and moist eucalypt forests and rocky areas.
Three-toed Snake-tooth Skink *Coeranoscincus reticulatis*	Vulnerable	L	No	Low habitat availability; prefers rainforest and occasionally moist eucalypt forest, on loamy or sandy soils.
Tree Guinea Flower	Endangered	L	No	Typically grows in heath, open forest or rainforest. Open forest present on site, but no individuals found
White-eared Monarch *Carterornis leucotis*	Vulnerable	L	No	Low habitat availability, prefers dry and littoral rainforest or rainforest margins.
White-flowered Wax Plant *Cynanchum elegans*	Endangered	N	No	No habitat on site; prefers rainforest and littoral rainforest
Willawarrin Double tail *Diuris disposita*	Endangered	N	No	Outside distribution range

* Likelihood of occurrence – see **Appendix G** for likelihood definitions.

Additional species credit species relevant to the study area which have not been generated by the credit calculator but appear in database searches are listed below in **Section 4.4.3**.

4.4.3 Other Candidate Species (BioNet records)

Additional candidate threatened species of potential relevance to the site have been identified through obtaining previous records within 10 km of the site in the 'BioNet' *Atlas of NSW Wildlife*. Targeted surveys for these species were included as part of the December 2015 field survey program and their potential relevance to the site has been documented in the 'likelihood of occurrence' assessments for the site in **Appendix G**. These species are discussed below in **Table 17.**

Of these species, one, the Little Bentwing-bat *Miniopterus australis*, was recorded on the site.

Table 17 Additional species credit species – NSW Wildlife Atlas (BioNet)

Species	BC Act	LoO*	Explanation (for presence/absence)
Australasian Bittern *Botaurus poiciloptilus*	Endangered	M	Moderate habitat availability in large quarry dams (in disturbed quarry area), prefers dense aquatic vegetation. No habitat in proposed expansion area.
Black Bittern *Ixobrychus flavicollis*	Vulnerable	M	Moderate habitat availability in large quarry dams (in disturbed quarry area), prefers dense aquatic vegetation. No habitat in proposed expansion area.

Species	BC Act	LoO*	Explanation (for presence/absence)
Brush-tailed Phascogale *Phascogale tapoatafa*	Vulnerable	M	Moderate habitat available. Foraging habitat abundant throughout woodland containing rough bark trees. Hollows-bearing trees for nesting are relatively scarce.
Comb-crested Jacana *Irediparra gallinacea*	Vulnerable	L	Moderate habitat availability in large quarry dams (in disturbed quarry area), prefers dense, floating aquatic vegetation. No habitat in proposed expansion area.
Black-necked Stork *Ephippiorhynchus asiaticus*	Endangered	L	Low habitat availability; prefers floodplain wetlands. Could potentially occur in quarry dams containing aquatic vegetation.
Dwarf Heath Casuarina *Allocasuarina defungens*	Endangered	N	Low habitat availability, prefers tall heath on sand, but can also occur on clay soils and sandstone.
Eastern Osprey *Pandion cristatus*	Vulnerable	L	No habitat available on the site.
Lesser Sand-plover *Charadrius mongolus*	Vulnerable	N	No habitat available on the site.
Little Bentwing-bat *Miniopterus australis*	**Vulnerable**	**P**	**Foraging habitat available on site. Roosting habitat predominately absent Breeding caves absent.**
Little Tern *Sternula albifrons*	Endangered	N	No habitat available on the site.
Maundia triglochinoides	Vulnerable	L	Low habitat availability, prefers swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay with low nutrients. Potential low quality habitat in ponds within quarry area. Not recorded.
Narrow-leaved Black Peppermint *Eucalyptus nicholii*	Vulnerable	N	No habitat available on site. Outside distribution range. Not recorded.
Pied Oystercatcher *Haematopus longirostris*	Endangered	N	No habitat available on the site.
Sooty Oystercatcher *Haematopus fuliginosus*	Vulnerable	N	No habitat available on the site.
Southern Swamp Orchid *Phaius australis*	Endangered	L	Site lies outside of distributional range (i.e. south of Evans Head). Potential habitat in low-lying western area of site. Not recorded during targeted orchid surveys.
Spider Orchid *Dendrobium melaleucaphilum*	Endangered	L	Habitat available in Melaleucas present on and adjacent to site (particularly western area). Not recorded during targeted orchid surveys (during known flowering period).

Species	BC Act	LoO*	Explanation (for presence/absence)
Terek Sandpiper *Xenus cinereus*	Vulnerable	N	No habitat available on site.
Wallum Froglet *Crinia tinnula*	Vulnerable	L	No habitat availability on site. Prefers habitats associated with acidic swamps on coastal sand plains or sedgelands and wet heathland. Occasionally in swamp sclerophyll forests.

* Likelihood of occurrence – see **Appendix G** for likelihood definitions.

4.4.4 Candidate Species Credit Species – present on site

According to Section 6.5 (Step 3) of the FBA, an assessor must establish whether a candidate threatened species is present on a development site or is likely to use the habitat available on the site.

Four fauna species credit species were recorded during the December 2015 field survey: Koala, Eastern Bentwing-bat, Grey-headed Flying-fox and the Little Bentwing-bat. According to the Threatened Species Profile Database, the Eastern Bentwing-bat, Little Bentwing-bat and Grey-headed Flying-fox attract both ecosystem credits and species credits within the Northern Rivers CMA. Species credits for these species are linked to the presence of breeding habitat, which in the case of the Eastern Bentwing-bat and Little Bentwing-bat is "land containing caves or similar structures" and for the Grey-headed Flying Fox, is "land within 40 m of rainforest, coastal scrub, riparian or estuarine communities". Neither of these habitat types or features is present on the site at Sancrox. By following the steps for identifying species credit species in Section 6.5 of the FBA, these three species were excluded from the species credit entries in the Credit Calculator for this project based upon the absence of breeding habitat on the site. For this reason, and for the purpose of this assessment, each was assessed as an ecosystem credit species (see **Section 4.3**).

By contrast, the Koala is a species credit species. A description of the occurrence of the Koala on the Development Site is provided below.

No threatened plants have been recorded on the site. However, targeted searches for threatened orchids were conducted in October 2015 and revealed a specimen of an epiphytic orchid that was initially thought to be the Spider Orchid *Dendrobium melaleucaphilum*. Flowering of this specimen during 2016 revealed that the specimen was not *D. melaleucaphilum.* This species is listed in the SEARs as a species for which impacts require "further consideration". Accordingly, a description of the surveys and results for this threatened orchid species is provided in **Section 6.4.2**.

Koala *Phascolarctos cinereus*

Vulnerable (BC Act and EPBC Act)

The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. It occupies a wide range of eucalypt forest habitats, usually where preferred browse species of eucalypt occur.

Surveys targeting the Koala were conducted during the BAR surveys in 2015. During the survey, evidence of the Koala was observed in the form of scats and possible tree scratches. Despite comprehensive searches for Koalas using visual searches and the Spot Assessment Technique (SAT) (10 plots in total – see **Appendix B**), no direct evidence (via sightings or aural recognition of male calls) of the Koala was recorded on the site. The results of the SPOT assessment indicate that Koala activity on the site is low.

A supplementary survey for the Koala was conducted in October 2020. The aim of the survey was to gather additional data on Koala activity and usage of the site, in response to BCD comments on the original BAR. The full report describing the methods and results of the Koala survey is provided in **Appendix H.** Field survey techniques comprised both diurnal RGb-SAT (Regularised Grid-based Spot Assessment Technique, or SAT), with 15 SAT sites sampled, along with two consecutive nights of spotlight searches. Field transects were carried out by Biolink and SLR ecologists.

Evidence of Koalas in the form of diagnostic faecal pellets was recorded at eight of the 15 sampled SAT sites and one individual Koala was recorded during spotlighting. Analysis of SAT data revealed two Koala activity cells adjoining the western edge of the quarry, reaching both the northern and southern boundary of the site, as well as another cell in the western portion of the site. The modelled Koala activity results suggest the site contains 'high use' areas, with one or more resident Koalas within the study area.

The total area of Koala habitat within the development footprint comprises all stands of native forest (ie all PCTs mapped on site), which is estimated to be 39.02 hectares. Based on the current survey results and modelled activity levels, combined with previous Koala survey results, and the widespread occurrence of several Koala feed trees within the forested parts of the site, the site is considered to be habitat for the Koala.

SEPP 44 Koala Habitat Protection

State Environmental Planning Policy No.44 Koala Habitat Protection (SEPP 44) aims to encourage the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range and to reverse the current trend of koala-population decline. It applies to areas of native vegetation greater than one hectare and in councils listed in Schedule 1 to the SEPP. Port Macquarie LGA is listed in Schedule 1 and the Project site is greater than one hectare. However, the Policy does not apply to Major Projects that are being assessed as State Significant Developments (SSD). Nonetheless, SEPP 44 Koala habitat definitions have been used in this section to determine potential and core Koala habitat areas. Port Macquarie Council koala habitat mapping, in combination with field survey results and vegetation mapping, was also used to identify Koala habitat within the study area.

The forested parts of the site contains two 'feed trees' as listed under Schedule 2 of SEPP 44: Tallowwood *Eucalyptus microcorys* and Small-fruited Grey Gum *E. propinqua*. These trees were found to constitute more than 15 % of the total canopy composition across the site, and accordingly the majority of the forested parts of the site would constitute 'potential Koala habitat' according to Clause 7 of SEPP 44. .

Koala Species Credits In light of the above results, there is requirement for preparation of a species polygon for the Koala according to Section 6.5 of the FBA. The species polygon includes all areas of native vegetation within the development footprint. This includes all patches of native PCTs mapped within the site (**Table 9**), which total 39.02 ha. Hence a species impact area for the Koala of 39.02 ha was entered into the Credit Calculator, generating a requirement for species credits (see credit results in **Section 6.3.2**).

5 Impact Avoidance and Minimisation

This chapter describes the impacts of the proposed development, in accordance with Section 8 of the FBA.

5.1 Impact Avoidance Measures

Hanson has endeavoured to avoid and minimise ecological impacts associated with the Project. This includes investigating the feasibility of using alternative quarry material, sites, extraction boundaries, operating hours and operation, whilst maximising the economic recovery associated with material extraction.

The following measures have been accepted by Hanson and would become commitments under the Project Approval. These measures would be described in a Biodiversity Management Plan for the project.

5.1.1 Extraction boundary

Avoid and minimise disturbance of native vegetations communities including:

- Redesign of pit to avoid or minimise disturbance to high value vegetation (ie threatened ecological communities listed under the BC Act, or 'EEC vegetation'). In this case, the pit layout was modified along its southern boundary to avoid clearing of the existing patch of Subtropical Coastal Floodplain Forest EEC (NR 117).
- Reduction in the development footprint from 60.6 hectares to 57.55 hectares. This area was refined based on geological and ecological constraints.
- The impact area was refined to minimise net impacts on biodiversity values (native vegetation and fauna habitats).

5.1.2 Site Selection

The proponent proposes to extend the life of the existing Sancrox quarry, rather than the opening of a new quarry in a nearby location. The use of the existing site allows for efficient use of existing quarry infrastructure, such as haul roads and shipping facilities; whereas developing an alternative site would require the purchase of additional land, exploration and construction of new quarry infrastructure.

Finding other resources of the same quality and reliability as what currently exists on the subject site is difficult as exploration of the surrounding area has identified only isolated pockets of good quality, consistent resource material located close enough to Port Macquarie as to be financially viable.

Selection of an alternative site for the Project would involve the acquisition of a new and/or 'greenfield' site which, apart from being more expensive than expanding the existing quarry, could potentially cause greater environmental impacts than the current proposal.

5.1.3 Optimising the proposed layout

The location and position of the existing resource within the study area (and current landholding) is such that expansion of the current quarry pit in a westerly direction requires clearing of existing native vegetation that cannot be avoided. The proposed quarry pit layout has been designed, as far as possible, to incorporate land already devoid of vegetation so as to limit the clearing of native vegetation where possible. As a result, 29 % of the development footprint includes cleared areas and areas of non-native vegetation.

Extending the proposed quarry footprint in other directions would not be viable as exploration investigations have only identified pockets of Metamorphic and volcanic rocks. The inconsistency of these pockets and the unknown suitability in hard rock applications make extending the quarry into areas containing these rock types unreliable.

With respect to optimising the layout of the proposed quarry pit, the following is also noted:

- The proposed pit expansion is required to be located adjacent and contiguous with the existing pit and associated infrastructure, due to the location of the geological resource, so there is no real possibility of locating the proposed pit to another location within the site (or beyond the site).
- The western boundary of the quarry has been rationalised (i.e. straightened) and pulled to the east, reducing potential 'edge effects' and ensuring that there is as much vegetation as possible for north-south connectivity for Koala and other fauna to move around the existing and proposed quarry pits.

5.2 Final Development Footprint Areas

The development footprint is defined as "*the area of land that is directly impacted on by a proposed Major Project that is under the EP&A Act, including access roads, and areas used to store construction materials*".

The development footprint includes clearing for the quarry expansion area, and the area designated for relocation of plant and access roads. The final development footprint is shown in **Figure 8** Total impact areas for the various features of the proposed development are included in **Table 18**.

The development footprint is approximately 57.55 ha, comprising 39.02 hectares (68 %) of native vegetation and18.53 ha (32 %) of areas devoid of native vegetation (i.e. areas not requiring further assessment under the FBA) (**Table 18**). The proposed quarry expansion will occur over the entire development footprint.

Table 18 Development Footprint Areas

Feature	Native Vegetation (ha)	Other (ha)#	Total (ha)
Pit footprint (Proposed Quarry Expansion Area)	31.72	9.14	40.86
Supporting infrastructure (administration buildings, plant, stockpiles, access and other ancillary works)	7.30	9.39	16.69
Total Area:	**39.02**	**18.53**	**57.55**

Areas not requiring further assessment (ie devoid of native vegetation)

As noted in **Section 1.3**, the BAR assesses the original proposed quarry footprint area (prior to decreasing the footprint to avoid the mapped flood risk area), and as such the proposed vegetation clearing estimates presented herein are representative of the larger originally proposed quarry footprint. The reduction in the quarry footprint will ultimately reduce vegetation clearing (by around 3.2 hectares).

5.3 Direct Impacts

5.3.1 Overview

According to the FBA, direct impacts on biodiversity values are described as "*an impact on biodiversity values that is a direct result of vegetation clearance from a development*. *It is predictable, usually occurs at or near to the development site and can be readily identified during the planning, design, construction, and operational phases of a development*."

The final development footprint will involve the following direct impacts:

- clearing of 39.02 ha of native forest vegetation;
- loss of hollow-bearing trees, some of which may provide potential roost sites and breeding habitat for a selection of bird, arboreal mammal, reptile and microchiropteran bat species; and
- removal of foraging habitat for locally occurring native fauna, in particular for threatened microchiropteran bats species, ground mammals, arboreal mammals and a range of bird species.

5.3.2 Impacts on vegetation zones

All native vegetation within the development footprint, which comprises the proposed expansion area and the area designated for relocation of plant, will be removed. Maps showing impacts on native plant communities are therefore equivalent to the PCTs shown in **Figure 7**. Impacts on native vegetation zones are shown in **Figure 8** and described in **Table 19**. The total area of vegetation removal required for construction and operation of the proposal is 39.02 ha, which represents 68 % of the development footprint. These areas of native vegetation will be replaced with permanent infrastructure for the proposed quarry and therefore impacts on native vegetation (and associated habitats) would be permanent (and unavoidable).

Table 19 Native Vegetation Impacts (clearing areas for vegetation zones)

Biometric Code	Vegetation Type Name	Condition	Clearing Area (ha)
NR247	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	Mod/Good	10.83
NR263	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Mod/Good	27.10
NR263	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Mod/Good_Poor	0.84
NR247	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	Mod/Good_Poor	0.25
		Total	**39.02**

5.4 Indirect Impacts

According to the FBA, indirect impacts on biodiversity values are described as follows:

> *"when development related activities affect threatened species, threatened species habitat, populations or ecological communities in a manner other than direct impact. Compared to direct impacts, indirect impacts often: occur over a wider area than just the site of the development; have a lower intensity of impact in the extent to which they occur compared to direct impacts; occur off site; have a lower predictability of when the impact occurs;* [and] *have unclear boundaries of responsibility."*

Indirect impacts in relation to the proposed development include:

- Potential for sedimentation and run-off to occur during construction and operation of the quarry and associated infrastructure. These are to be managed using appropriate sediment and erosion control measures and in accordance with an engineered stormwater management system (see EIS).
- There is some potential for animal strike (particularly macropods and birds) by increased traffic across the site. The speed limit will be reduced to 40 km/hr along the access road and at these speeds animal strikes are unlikely.
- Deposition of dust on vegetation adjoining the quarry, leading to reduced plant health and foraging quality for local native fauna.
- An increased presence of weeds is a possibility across the site. Weed management is to be integrated into the construction and operational management measures. Vehicle wash down is proposed and implementation of property maintenance will reduce the likelihood of weeds entering retained or adjacent areas of native vegetation.
- Rubbish and pollution may enter the site from staff or during the general day-to-day operation of the facility. To reduce the likelihood of waste entering the environment, all waste materials from the facility are proposed to be collected and transported off site for disposal or distribution. Skip bins will be provided and regularly maintained for other general waste.
- Edge effects, refers to potential reduction in habitat quality and associated adverse effects on flora and fauna along the edges of proposed development, where native vegetation and habitat adjoin development. In the case of Sancrox Quarry, the existing pit has been in place for several years and therefore the adjoining bushland around the perimeter of the pit would already be subject to edge effects. Such effects would theoretically include several of the indirect impacts listed above, including increased prevalence of weeds, increased light (or light spill) in adjoining areas, increased noise levels, and dust deposition on leaves. The proposed quarry expansion will relocate the zone of potential edge effects further west and create a larger total pit area, thereby increasing the perimeter of the edge. However, it is not likely that any theoretical edge effects along this perimeter will be any different to those active at present. Moreover, there was little evidence that any edge effects were active around the edges of the existing pit during field surveys and notably the recent sighting of the Koala was within a few metres of the western margin of the existing pit. It is therefore doubtful that any edge effects, if occurring, are likely to adversely affect local populations of native flora and fauna. Moreover, there are not likely to be any threatened species affected by edge effects, as no such species are likely to be inhabiting the fringes of the proposed pit footprint, or rely on those areas for their breeding or other life cycle processes.

It is noted that the FBA[2] does not contain a method for quantifying indirect impacts. Given the above considerations, the retirement of biodiversity credits to offset any indirect impacts is not warranted. However, suitable mitigation measures to minimise the risk of adverse effects arising from indirect impacts are provided below in **Section 5.5**.

[2] Furthermore, it is noted that the BAM does not determine a credit obligation for indirect impacts.

5.5 On-site Mitigation Measures

5.5.1 General

A selection of best management practices and mitigation measures will be implemented as part of the proposed development to prevent, minimise and/or manage the potential for adverse impacts upon the local environment and surrounding populace. Mitigation measures proposed during the construction and operational phases of the project include:

- A Biodiversity Management Plan (BMP) to be prepared to outline the clearance procedure, protocols for Koala finds and incidents and include an educational brochure for all workers to review prior to working at Sancrox.
- pre-clearance surveys (by qualified ecologist) immediately prior to the removal of any vegetation to give the clearance go ahead.
- Progressive rehabilitation of disturbed areas will be completed using locally indigenous plant species (see **Section 5.5.2**).
- Weed, sediment and erosion control before, during and after construction.
- Environmental management plans will be developed and implemented.
- Ecologist or wildlife /handler rescuer to be present during vegetation clearing to minimise impacts on threatened fauna (including the Koala, if present) displaced or injured during clearing.
- A Biodiversity Offset Strategy (BOS) will be prepared to offset the residual impacts on biodiversity value arising from the Project (see **Section 7.8**).
- Fencing around remnant native vegetation to be retained within the quarry site.
- Speed limits for vehicles within the site (to minimise risk of collisions with native fauna).
- Measures to restrict vehicles to designated haul roads.

A site-specific Operational Environmental Management Plan (EMP) for the proposed quarry to ensure that the commitments made within this EIS, along with relevant statutory obligations and the conditions of development consent (including Environment Protection Licence (EPL) requirements), are fully implemented and complied with.

A Landscaping Strategy will be prepared and implemented to screen the development from neighbouring landholders and generally improve the visual and environmental amenity of the development site.

On-site mitigation measures to reduce direct and indirect impacts include before, during and after construction measures as outlined in **Table 20** below.

Table 20 Mitigation measures to be implements before, during and after construction

Action	Outcome	Timing	Responsibility
Before Construction			
Pre-clearing surveys	Fauna residing within or occupying the expansion area are safely and ethically salvaged and relocated	Prior to tree felling or other related works	Project Ecologist

Action	Outcome	Timing	Responsibility
Protection of native vegetation	Delineate quarry expansion limit (to ensure no native vegetation outside expansion area is cleared)	Prior to and for the duration of any works	Construction contractor
Erosion and sediment control measures	Install and maintain erosion and sediment control measures in accordance with the requirements of the 'Blue Book' (Landcom 2004).	Prior to and for the duration of any works	Construction contractor
During Construction			
Fauna management	Supervision of tree felling to rescue and recover any fauna (as necessary)	During clearing	Project Ecologist
Weed Management	Vehicle wash-down Site weed control program Prepare weed control plan	Prior to and for the duration of any works	Project Ecologist
Rubbish management	Rubbish (such as food scraps and building waste) are to be properly managed during construction and must not be stockpiled on areas of native vegetation	Ongoing	Construction team
Exposed soil surface management	Revegetation – using re-use of topsoil layers and seeding of pasture grasses and legumes (see EIS)	Immediately following soil disturbances	Construction team
Traffic management	Speed limits of 40 km/hr to be imposed within site, reducing the likelihood of animal strikes. Educate workers on possibility of animal strike through construction management program	Ongoing	Construction team
Revegetation	Design and implement planting plan for corridor of native vegetation east and west of proposed quarry pit, to maintain north-south corridor link of canopy trees, as per sub-regional corridor in Greater Sancrox Structure Plan	During construction	Proponent (with Project Ecologist)
Post- Construction			
Traffic management	Speed limits of 40 km/hr are proposed, reducing the likelihood of animal strikes	Ongoing	Site operator
Weed management	Limit spread of weeds along with landscape maintenance program	Ongoing, half-yearly minimum	Site operator
Increased artificial light	Each luminaire will be aimed downwards and only switched on during loading-unloading and servicing activities outside of daylight hours and during heavy fog.	Ongoing	Site operator

Action	Outcome	Timing	Responsibility
Waste management	Appropriate systems will be implemented to ensure that each waste stream generated by the development is effectively managed and/or disposed of off-site (see detail in EIS). There will not be any on-site stockpiling or disposal of waste materials.	Ongoing	Site operator
Rehabilitation (Revegetation)	Maintain and monitor plantings within proposed native vegetation corridors east and west of quarry pit (See below)	Post-construction; operational life of quarry	Proponent (with Project Ecologist)
Surface water and run-off	An engineered surface water drainage and management strategy is to be prepared and implemented. Techniques currently proposed to manage stormwater include bunding walls, swales, underground water capture systems and dams (see EIS)	Ongoing	Site operator

5.5.2 Rehabilitation

Progressive rehabilitation will be a key component of the expansion project and would be undertaken in accordance with an approved Biodiversity and Rehabilitation Management Plan in consultation with DPIE, Local Council, Natural Resource Access Regulator and the Biodiversity Conservation Division, with final approval of the plan subject to review by DPIE.

Hanson's broad objective for progressive and final rehabilitation are to crease a final landform that is suitable for post-quarrying land uses. This includes the following specific objectives:

- To produce a geotechnically stable, safe and non-polluting landform through progressive shaping of the completed areas of the Quarry.
- To provide a landform that is free-draining and has low maintenance requirements.
- To blend the landform with the surrounding landscape through careful selection of species for revegetation.
- To monitor the success of rehabilitation over time to ensure revegetation is not dying back.
- Ensure that the final landform maintains the visual amenity of the locality and, where possible, enhances local biodiversity values.

Final Landuse and Rehab Overview

The primary final land use for the Quarry would be a stable and safe final landform that permits passive biodiversity conservation and maintenance of an established vegetated buffer and amenity barrier to shield views to the final landform. Dams and diversion drain would form a component of this landscape to limit erosion and sediment movement.

To improve visual amenity of the area and to provide use of the area as habitat, Hanson would progressively revegetate completed benches within the Quarry. Most of these rehabilitated areas would support vegetation and fauna habitat for long periods.

Upon cessation of quarrying it is anticipated that all Quarry-related infrastructure would be decommissioned and removed from the site. All waste material would be removed to a licenced landfill.

It is anticipated that progressive rehabilitation would initially focus on the amenity barrier (once constructed). Topsoil would be actively placed on the constructed barrier to support vegetation establishment. The surface would be revegetated with a mix of local native flora.

Terminal benches would be progressively profiled to be geotechnically stable and graded to ensure free drainage away to the sides of the benches. The benches would be then covered with overburden and topsoil and revegetated with local indigenous species suitable for a rocky ledge environment.

Rehabilitation of the Processing Stockpiling Area would first require a contamination assessment focused on fuel storage areas. The final surface would be profiled to drain and would be deep ripped to remove any compacted gravel sheeting. Overburden and topsoil would be applied, and surface would be revegetated with a mix of local native flora.

All redundant roads and tracks will be removed and scarified to a minimum of 75mm depth and prepared for revegetation. The access road may remain open and sealed to provide permanent access to the landform.

Fencing (or a similar barrier) will be erected where necessary to exclude and prohibit unauthorised entry into areas that have been rehabilitated. Signs will be placed in prominent locations to indicate areas that are undergoing rehabilitation.

This will be particularly important at the upper benches of the Quarry where trespassing may result in injury or death.

Revegetation Overview

The Project seeks to recreate native vegetation communities similar to those in the surrounding landscape. It is proposed to match the existing vegetation in both the upper canopy and understorey species. Hanson will seek to achieve a similar percentage of foliage cover, litter depth, microbial activity and ultimately canopy height.

A detailed plan of each stage will be prepared prior to rehabilitation works commencing. Native vegetation will largely be established using direct seeding and from the seed store within respread topsoil. Supplementary native pasture and/or tubestock planting will be undertaken where specific species combinations are required.

Rehabilitation of terminal benches would be undertaken progressively once extraction in that location is complete and the bench is no longer required for access to other part of the Quarry. As the extraction progresses through the resource, 10 m wide benches will be left every 10 m of depth to provide a horizontal platform on which native flora species will be established.

The revegetation program will re-establish native tree, shrub and ground cover and will aim to stabilise reshaped and benched areas. Benches will be treated to actively promote infiltration of water, which will enhance soil moisture requirements for direct tree seeding and minimise surface runoff to underlying benches and the pit floor dirty water control system. Revegetation will also visually screen disturbed areas and will re-establish habitat for native fauna; and Any dead trees will be replaced quickly to keep the overall progress of the re-vegetation maturity on track.

Revegetation methods

Direct seeding (via broadcasting) is preferred over tube stock planting as it enables a far greater success rate, limits the need for ongoing maintenance (e.g. watering) and is the most effective method in achieving a successful rehabilitation outcome. Notwithstanding this, tubestock will be utilised in landscape planting around the Quarry. Not all native trees and shrubs are suited to direct seeding due to their innate germination requirements, therefore, it may be required to supplement with some tubestock to increase biodiversity.

A mixture of native trees and shrubs endemic to the area will be sown onto the majority of the reshaped and benched pit areas following topdressing and site preparation. This tree and shrub seed will complement natural regeneration from seed contained within the soil seed bank. The seed mix used for revegetation of the disturbed quarry area will include some of the major tree and shrub species recorded on site.

Growth rates of between 1m and 2m per year can be initially expected for many of the more dominant trees and shrubs. The correct treatment and application of seed in the appropriate ratios is important in controlling emerging weeds and in allowing the tree stand to develop in a positive direction. The native tree and shrub seed mix will be sown at a suitable combined rate. Seed will be broadcast evenly onto top dressed areas. Care will be taken to ensure it will not be buried.

Seeding will be conducted in late spring, summer and early autumn giving superior results due to higher ground temperatures. Revegetation activities will generally be undertaken in spring and autumn; however opportunistic revegetation will be undertaken if areas become available for sowing in summer or winter. After surface soil amelioration and tillage is completed for any given area, revegetation will commence as soon as practicable. The proposed method of sowing will be via conventional spreading using agricultural broadcasting equipment, or by hand if the terrain is difficult and machinery use is not possible; and slope stabilising techniques such as hydro seeding and straw mulching will be undertaken on slopes exceeding 18 degrees for enhancement of pasture germination.

6 Impact Summary

This chapter describes the impact of the proposed development in terms of biodiversity credits, in accordance with Section 9 of the FBA.

6.1 Areas Not Requiring Further Assessment

Areas that do not require further assessment are those that do not contain native vegetation, as per Section 9.5 of the FBA (unless otherwise required by the SEARs). Of the development site, around 18.53 ha (29%) does not contain native plant communities. These areas, which do not require further assessment (and hence do not require offsets), are shown in **Figure 7** and **Figure 8**.

6.2 Entities Not Requiring Offsets

Impacts for which the assessor is not required to determine an offset (FBA, Section 9.4) comprise:

- Vegetation clearing within a vegetation zone that has a site value score of less than 17 and the PCT is not a TEC;
- Impacts on PCTs that are not threatened species habitat and are not TECs;
- Threatened species habitat within a vegetation zone that has a site value score of <17; and
- Species or populations that are not threatened and do not form part of a TEC.

All vegetation zones mapped and assessed have current site value scores greater than 17 and all zones represent potential threatened species habitat (subject to the findings outlined in **Chapter 4**). Hence, the only entities not requiring offsets are areas of native vegetation that will not be subject to clearing as part of the proposed development.

6.3 Impacts Requiring Offsetting

According to Section 9.3 of the FBA, impacts on native vegetation that require an offset include:

- Impacts on EECs and CEECs, unless specifically nominated in the SEARs as an impact requiring further consideration; and
- impacts on PCTs associated with threatened species habitat and in a vegetation zone that has a site value score of >= 17.

6.3.1 PCTs Requiring Offset

All vegetation zones mapped with the site have current site value scores of over 17 (see **Section 6.5.1**) and represent habitat for at least one threatened species; hence any clearing in these vegetation zones would require an offset. Accordingly, the PCTs within which clearing will occur and which require an offset are:

- Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion; and
- Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast.

The PCTs requiring offset and the corresponding number of ecosystem credits required are listed in **Table 21**. Mapping showing the areas of PCTs and vegetation zones requiring offsetting is presented in **Figure 7** and **Figure 8**, respectively.

Table 21 PCTs requiring offset and credits required

PCT Code	PCT Name#	TEC	Clearing Area (ha)	Credits Required
1215	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion (NR247)	No	11.08	505
1262	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast (NR263)	No	27.94	1725
	Total:		**39.02**	**2230**

Based on online NSW BioNet Vegetation Classification Database

Threatened ecological community, as listed under the BC Act

The Credit Report for development impacts is provided in **Appendix I.**

6.3.2 Species Polygons Requiring Offset

A species polygon for one species credit species, the Koala, has been created and species credits calculated in Credit Calculator according to the FBA to offset the loss of habitat for this species. A total of 39.02 ha of Koala habitat will be removed for the project, generating a requirement for 1015 species credits.

As discussed in Chapter 4 of this report, no other individuals or populations of threatened species that generate species credits were recorded within the Development Site. In addition, with regard to species that attract both ecosystem credits and species credits that were candidate species recorded on the site, and the species credit component is associated with breeding habitat for those species (i.e. Grey-headed Flying Fox, Little Bentwing-bat and Eastern Bentwing-bat), no such breeding habitat is present on the site for those species. Hence, the creation of species polygons for such species is not required for this assessment. Hence there are no other species credit polygons that require offset as part of the proposed development.

6.4 Impacts Requiring Further Consideration

In the attachments to the SEARs (see **Appendix A**), OEH identify impacts that require further consideration. OEH states "Impacts on the following species, populations and ecological communities will require further consideration and provision of the information specified in s.9.2 of the Framework for Biodiversity Assessment:

- Biconvex Paperbark *Melaleuca biconvexa*;
- Spider Orchid *Dendrobium melaleucaphilum*; and
- Southern Swamp Orchid *Phaius australis*."

No evidence for these threatened plant species was recorded during field surveys conducted for this BAR. It is noted that targeted searches for threatened plants were conducted across the site on several occasions during 2015 and 2016, including during the known flowering period of the two orchid species and no individuals of these species were recorded. The methods and results of the targeted orchid survey are discussed in the report attached in **Appendix J.**

Section 9.2 of the FBA sets out the information to be included in the BAR on threatened species requiring further assessment. Regardless of the lack of evidence for the above listed species, a brief description of the surveys conducted for these species and their ecology, habitat and distribution is provided below.

6.4.1 Biconvex Paperbark *Melaleuca biconvexa*

The *Melaleuca biconvexa* is a small to medium size shrub that grows up to 10 m tall, occasionally growing as tall as 20 m. It is only found in a limited extent with populations scattered throughout coastal NSW. Swamp, swamp margins and creek edges are essential habitat for *Melaleuca biconvexa* as it generally grows on low lying alluvial soils on sheltered aspects.

The bark of *Melaleuca biconvexa* is typical of the Myrtaceae family. The leaves of the species are distinctive as they are small, 18 mm long and 4 mm wide, and emerge in pair at right angles from the branch. Each leaf has a central vein with the leaf blade curving upwards on either side of the vein.

The species flowers over a four week period in September and October, producing white flowers in dense clusters. The fruits of the species are typically urn shaped and approximately three to five mm in diameter.

BioNet search results have identified numerous records of *Melaleuca biconvexa* approximately four kilometres to the south of the site. No individuals of *Melaleuca biconvexa* have been recorded during any of the surveys conducted on the site to date, despite targeted searches in areas of suitable habitat. Given that this species is not cryptic and can be readily identified via leaf morphology at any time of year, there is a low likelihood that this species occurs on the site.

6.4.2 Spider Orchard *Dendrobium melaleucaphilum*

This section summarises targeted surveys and assessments for threatened orchid species carried out across the Development Site by SLR in October 2015. A copy of the report that documents the methods and results of the survey (SLR 2016) is provided in **Appendix J.**

D. melaleucaphilum (Family Orchidaceae) is an orchid which grows on other plants (i.e. epiphytic) and sometimes on rocks (i.e. epilithic) and occurs in coastal districts and nearby ranges, extending from Queensland to its southern distributional limit in the lower Blue Mountains in New South Wales (NSW). In NSW, it is currently known from seven recent collections (OEH 2012). Stems are spreading to drooping, thin and wiry in the basal half, succulent, swollen and square in cross section in the upper half, tapering towards the tip, rooting only at the base. This species grows frequently as an arboreal epiphyte of *Melaleuca styphelioides*, less commonly on rainforest trees or on rocks. Flowering occurs between July and October. It is listed as 'endangered' under the BC Act, but is not listed under the EPBC Act.

In terms of identification and morphology, *D. melaleucaphilum* is very similar to the closely related *D. tetragonum*, which has dorsal sepals 19 – 30 mm long and labellum only up to 10 mm long. *D. melaleucaphilum* was previously known as the 'large-flowered paperbark form' of *D. tetragonum* (PlantNET 2015a). Hence, these two species cannot, strictly speaking, be distinguished unless in flower.

One orchid specimen with similar characteristics to the Spider Orchid *Dendrobium melaleucaphilum* was recorded growing on the trunk of a Prickly-leaved Paperbark *Melaleuca styphelioides* on the western limit of the proposed quarry expansion area (see **Photo 1**). The identity of the *Dendrobium* was initially uncertain, as the specimen recorded was not in flower at the time of the survey. However, photographic evidence of the orchid collected during flowering in August and September 2016 revealed that the specimen was *Dendrobium gracilicaule* or possibly a hybrid *Dendrobium gracilicaule* x *D. tarberi* (see **Photo 2**). *Dendrobium gracilicaule* or its hybrid forms are not listed as a threatened species in the BC Act or EPBC Act. Hence, no threatened orchids have been recorded on the site as part of the current investigation.

Photo 1 Specimen of *Dendrobium gracilicaule* x *D. tarberi* (post-flowering, October 2015)

Photo 2 Specimen of *Dendrobium gracilicaule* x *D. tarberi* (flowering, September 2016)

BioNet search results have identified one record of *Dendrobium melaleucaphilum* within 10 km of the site. The species has not been recorded within five km of the site.

6.4.3 Southern Swamp Orchid *Phaius australis*

The Southern Swamp-orchid *Phaius australis* (Family Orchidaceae) is a terrestrial (ground dwelling) orchid and produces the largest flowers of any Australian orchid (TSSC 2014). Each plant has 4–8 large, pleated leaves and 1–2 flower stalks. The leaves are long (approx. 70 cm) and narrow, in relation to width (3–10 cm wide). The flowers are red-brown with yellow veins inside the flower and grow in spikes on stalks that are 70–110 cm long (TSSC 2014).

P. australis grows in *Melaleuca quinquenervia* swamps and in sclerophyll forest, on the coast, at or near sea level (PlantNET 2015). It has been reported north from Lake Cathie, but chiefly north from the Evans Head district (PlantNET 2015). OEH (2014) notes that the species "Occurs in Queensland and north-east NSW as far south as Coffs Harbour". Historically, it extended farther south, to Port Macquarie". On this basis, the site at Sancrox is outside of the range limit of this species.

BioNet search results have identified one record of *P. australis* within 10 km of the site. The species has not been recorded within five kilometres of the site. Potential habitat for *P. australis* occurs within the small patch of Blackbutt-Pink Bloodwood shrubby open forest (NR117) beyond the southern boundary of the Development Site and within stands of swamp forest and paperbark forest within the proposed Offset Site. No individuals were recorded during targeted orchid surveys conducted during the flowering period of this species. Given that the distributional limit of the species doesn't include the study area at Sancrox and the lack of evidence for the species on the site, there is a low likelihood that this species could potentially occur on the site.

6.4.4 Impacts Requiring Further Consideration – General

There are no other impacts that require further consideration by the consent authority for the proposed development at Sancrox. With reference to the thresholds for such impacts in **Table 4** and Section 9.2 of the FBA:

- There are no significant rivers and streams, important wetlands or estuarine areas within the study area; hence there will be no impacts that substantially reduce the width of the riparian buffer zone of such features;
- There are no State significant biodiversity links within (or adjoining) the study area. Hence, the proposal will have no effect on the movement (of native fauna) along such links (corridors);
- The estimated impacts on native vegetation, as described in **Section 5.3** of this report, are in no way likely to cause the extinction (or significantly reduce the viability) of a threatened ecological community in the Macleay-Hastings IBRA subregion. ;
- There is no critical habitat within the study area;
- There are no threatened species or populations nominated in the SEARs as likely to become extinct (or have their viability reduced significantly) in the IBRA subregion if affected by the development; and
- The predicted impacts of the proposal on native vegetation are not likely to impact on a critically endangered species, or on any species that have not previously been recorded in the IBRA subregion on the *Atlas of NSW Wildlife* database.

6.5 Biodiversity Credit Requirement

The BioBanking Credit Calculator has been used to calculate the impacts of the proposed development and potential offset requirements, in accordance with Section 8 of the FBA. This section of the report provides a summary of the results of the credit calculations. A full copy of the credit profile for the impacts of the proposal is provided in **Appendix I**.

6.5.1 Ecosystem credits

The ecosystem credits required to offset the proposed development are listed by vegetation zone in **Table 22**. A total of 2,230 ecosystem credits would be required to offset the clearing of native vegetation as part of the proposed development. The Credit Calculator identifies matching ecosystem credits (and IBRA subregions) that can be used to offset these impacts (see **Section 6.6**).

Table 22 Vegetation zones requiring offset and credits required

Zone Name	Vegetation type name	Zone area (ha)	Current site value	Future site value	Credits
NR247_Mod-Good	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	10.83	55.21	0	494
NR263_Mod-Good	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	27.10	78.00	0	1701
NR263_Mod-Good-Poor	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	0.84	32.89	0	24
NR247_Mod-Good-Poor	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	0.25	51.04	0	11
	Total	**39.02**			**2230**

The ecosystem credit required for offsetting the proposed development is summarised further in **Table 23**.

Table 23 Ecosystem credits required for offsetting the proposed development

Biometric Code	Ecosystem Credit Type	Credits
NR247	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	505
NR263	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	1725
	Total	**2230**

6.5.2 Landscape Value Score

Landscape score for the Development Site was calculated as described in **Section 2.9**. The loss in landscape value score has been calculated in Credit Calculator as 17, as per the Full Credit Report in **Appendix I**.

6.5.3 Species Credits

The proposed development will require the removal of 39.02 ha of Koala habitat. According to the FBA, this will necessitate the retirement of 1015 species credits to offset the loss of habitat. BioBanking credit reports showing the species credit requirement are provided in **Appendix I.**

No other species polygons are required for impacts on threatened species that attract species credits because either:

- the species credits are associated with breeding habitat that is not present on the site (i.e. in the case of the Grey-headed Flying Fox, Little Bentwing-bat and Eastern Bentwing-bat) and impacts on those species with 'split credits' are addressed through generation of ecosystem credits; or
- the species was not recorded on the site during threatened species surveys and is considered unlikely to occur on other than a transient or temporary basis.

6.6 Biodiversity Credit Report

Copies of the BioBanking credit reports are provided in **Appendix I**. **Table 24** lists the credit types required to offset the proposed development and the matching credits and IBRA subregions that can be used as 'offset options'. Any such credits can only be used as substitutes (or offset options) for credit types required if they belong to an IBRA subregion that adjoins the IBRA subregion in which the development occurs (i.e. Macleay-Hastings IBRA subregion).

Table 24 Ecosystem credits required for offset and matching credit types

Ecosystem Credit Required	No. Credits	Offset Options
Tallowwood Small fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast, (NR263)	1725	• Tallowwood Small fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast, (NR263) • Blackbutt Tallowwood dry grassy open forest of the central parts NSW North Coast Bioregion, (NR119) • Blackbutt Turpentine open forest of the foothills of the NSW North Coast Bioregion, (NR124) • Blackbutt grassy open forest of the lower Clarence Valley of the NSW North Coast Bioregion, (NR125) • Brush Box tall moist forest of the northern ranges of the NSW North Coast Bioregion, (NR144) • Red Mahogany open forest of the coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion, (NR222) • Tallowwood dry grassy forest of the far northern ranges of the NSW North Coast Bioregion, (NR267)
Spotted Gum Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion, (NR247)	505	• Spotted Gum Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion, (NR247)
Total Credits	**2,230**	

7 Biodiversity Offset Strategy

This chapter provides the Biodiversity Offset Strategy, based on outputs of the BioBanking Credit Calculator, in accordance with Section 10 of the FBA.

7.1 Overview

The assessment completed as part of this BAR has determined that a biodiversity offset is required in accordance with the FBA and the *NSW Biodiversity Offsets Policy for Major Projects* (the 'Offsets Policy', NSW Government and OEH 2014).

According to the Offsets Policy, a *Biodiversity Offset Strategy* (BOS) is required to set out how the proponent intends to fulfil the project's offset requirement and is to be submitted to the Department of Planning & Environment with the project application. Offsets are generally required to be secured prior to commencement of construction, although this can be deferred if a Voluntary Planning Agreement (under the EP&A Act) is entered into prior to project approval.

In relation to the SEARs, OEH state that biodiversity offsets for the project should complement offset options discussed in the *Greater Sancrox Draft Structure Plan 2014-2034* for the lands adjacent to the quarry.

7.2 Biodiversity Matters Requiring Offsetting

The offset requirement for the project is described in **Section 6.5**. The following biodiversity credits (as calculated using the FBA) are required to offset the proposed development:

- A total of 2,230 ecosystem credits, with the type and number of required ecosystem credits, and matching credit options, listed in **Table 24**.
- A total of 1,015 Koala species credits.

7.3 Overview of Offset Options

A summary of the available offsetting options, listed in order of priority, for the proposed development at Sancrox are listed in **Table 25**.

According to the Offsets Policy, proponents can meet their offset obligations through one or a combination of the following offset options:

- Like-for-like credit purchase – the proponent purchases the required number and type of BioBanking credits from the BioBanking credit 'market' (publicly available through the BioBanking Credit Register);
- Like-for-like credit creation - the proponent establishes a Stewardship Agreement on their own land, which generates the required credits to fulfil their offset requirement; the proponent retires the required number and type of credits from their own portfolio of credits;
- Variations – where like-for-like offsets are not available, and the proponent can demonstrate that "reasonable steps" have been taken to find a suitable offset, proponents may apply the FBA 'variation rules' (as outlined in Appendix A of the Offsets Policy);
- Rehabilitation of mine sites, which is not relevant to the current project;
- Supplementary measures. Supplementary measures are not preferred by the proponent; and/or

- Payment to Biodiversity Conservation Fund (BCF). Under this scenario, the proponent calculates the equivalent monetary value of their offset credit requirement using the Biodiversity Offsets Payment Calculator and pays this amount into the Fund.

Table 25 Options for Biodiversity Offsets for SSD projects

Offset Option	Offset Options/Comments

Purchase and retire matching (like-for-like) ecosystem credits	• Like-for-like ecosystem credits comprise:
	  ◦ Those of same PCT; or
	  ◦ A PCT from the same vegetation class that has equal or higher percentage cleared value for the CMA;
	• See list of matching credit types in **Table 24**;
	• Number and type of credits must be available on credit register, or will become available prior to construction (or during timeframe specified in in the Conditions of Approval for the SSD project application)

Create ecosystem credits through Stewardship Agreement over Offset Site	• Requires proponent to find suitable properties for sale in the IBRA subregion, purchase property (or properties) and set up Stewardship Agreement (pursuant to BC Act) over the land; • A potential Offset Site under ownership of proponent adjoins the Development Site; • Proposed Offset Site contains one matching ecosystem credit type; • Number and type of species credits in Offset Site not known but can be confirmed through targeted surveys or expert report (optional); • Proponent retires ecosystem credits generated on Offset Site to partially offset current project.
Variation rules - Purchase and retire other credits within same vegetation formation	• Apply variation rules when matching credit types in **Table 24** not available; • Find ecosystem credits for PCTs that fall within same formation, with equal or greater % cleared value.
Supplementary measures	• Apply FBA variation rules • Apply when suitable credits and/or biobank site unavailable or cannot be secured within BOS and construction timeframe
Fund Payment	• Proponent uses BOPC# to calculate monetary value of credits, and then applies to make payment of this amount into Biodiversity Conservation Fund. Confirmation of payment is then used to comply with relevant Condition of Approval for the SSD.

Biodiversity Offsets Payment Calculator, established under the NSW Biodiversity Offsets Scheme pursuant to the NSW *Biodiversity Conservation Act 2016*.

Where the proponent has demonstrated "reasonable steps" have been taken to find a suitable like-for-like offset, but none are available, 'supplementary measures' can be used to fulfil offset obligations. The rules for applying and calculating supplementary measures are provided in Appendix B of the Policy.

With the advent of the BC Act, proponents of SSD applications can now fulfil their biodiversity offset obligations through payment of the equivalent value of the biodiversity credits to the NSW Biodiversity Conservation Fund. This option is discussed further in **Section 7.7**.

A proponent may use a combination of measures to fulfil an offset requirement. All feasible offsetting options, as applicable to the proposed development at Sancrox, have been considered and are discussed in the following sections.

7.4 Like-for-Like Offsets

7.4.1 Purchase Like-for-Like credits

The proponent may choose to purchase and retire some or all of the credits required for offsetting a project from the credit market ('BioBanking Credit Register'). Suitable like-for-like credits types that could be purchased for the Sancrox SSD project are listed in **Table 24.** However, at the time of writing, these credits are not available on the BioBanking Credit Register and no applicable expressions of interest are currently published showing an availability of these credit types within the Northern Rivers IBRA region.

7.4.2 Generate Credits via Stewardship Agreement[3]

The proponent may choose to create a Stewardship Agreement over a portion of land in order to generate biodiversity credits and retire these to fulfil an offset obligation (in part or in full) for an SSD application.

For the proposed development at Sancrox, the proponent owns surplus land adjacent to the Development Site, being the northern portion of Lot 2 (see **Figure 2**), that contains native vegetation, some of which comprises matching ecosystem credit types for those that are to be cleared within the Development Site. The proposed 'Offset Site' is described in **Section 7.8**.

7.5 Apply Variation Rules

In the case where the required credits are not available, and hence a 'like-for-like' offset is not achievable, proponents can apply the variation rules for matching ecosystem credits. However, a hierarchy of options must be followed, with the proponent demonstrating that "all reasonable steps have been taken…to secure a matching ecosystem credit".

The consent authority may approve a variation of the offset rules for matching ecosystem credits, by allowing ecosystem credits created for a PCT from the same vegetation formation as the required ecosystem credit to be proposed as part of the BOS, where in the consent authority's opinion the BOS demonstrates that:

- all "reasonable steps" to secure a matching ecosystem credit have been taken by the proponent, and
- the required ecosystem credit is not for a PCT associated with a CEEC listed on the BC Act or an ecological community listed on the EPBC Act, and
- the PCT from the same vegetation formation has a percent cleared value of the PCT in the major catchment area equal to or greater than the percent cleared of the PCT to which the required ecosystem credit relates, or

[3] Note: this BAR has been prepared according to the FBA, which refers to Biobanking Agreements established under the former NSW *Threatened Species Conservation Act 1995*. References to Biobanking Agreements in this version of the BAR have been replaced with 'Stewardship Agreements' which are established under the BC Act.

- where the required ecosystem credit is for a PCT that is associated with a CEEC/EEC, the PCT from the same formation is also associated with a CEEC/EEC.

"Reasonable steps" to locate like-for-like offsets are listed in Appendix A of the Offset Policy and summarised as follows:

- investigating land already owned by the proponent within the IBRA subregion, whether the development site or other properties;
- liaising with an OEH office and local council to obtain a list of potential sites that meet the requirements for offsetting;
- placing an Expression of Interest for the credits wanted on the BioBanking public register (i.e. the 'Credits Wanted Register') for at least six months, whilst regularly checking the register to see if the required credits have become available;
- considering properties for sale in the "required area" (i.e. within the IBRA subregion); and
- providing evidence of why offset sites are not feasible (e.g. unwillingness of a landowner to sell).

By applying the variation rules, the proponent may purchase and retire ecosystem credits from the same vegetation formation (see **Table 10**), as follows:

- Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion (NR247), ecosystem credits for PCTs within the 'Dry Sclerophyll Forests' formation, with >35 % cleared value for the CMA.
- Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast (NR263), ecosystem credits for PCTs that fall within the 'Dry Sclerophyll Forests' formation, and that have >30% cleared value for the Northern Rivers CMA.

At the time of writing, no ecosystem credits within the vegetation formations listed above are available on the credit register or through the EOI web page. To demonstrate reasonable steps, the proponent should advertise the credit requirement via an Expression of Interest.

7.6 Supplementary Measures

Where a proponent can demonstrate that all reasonable steps have been taken to obtain like-for-like credits or a suitable offset site (as per the steps listed above), they can choose to use 'supplementary measures'. A formula for calculating the monetary contribution of supplementary measures is provided in Appendix B of the Offset Policy. Supplementary measures are not preferred as an offsetting option for the project application.

7.7 Fund Payment

The *Biodiversity Conservation Act 2016* and the *Biodiversity Conservation Regulation 2017* established the Biodiversity Offsets Scheme, which provides a mechanism to avoid, minimise and offset biodiversity impacts through land use planning and during the development assessment process. Under the Scheme, proponents can choose to make payments into the Biodiversity Conservation Fund to discharge an offset obligation, calculated using the Biodiversity Offsets Payment Calculator. The NSW Biodiversity Conservation Trust will then secure the biodiversity offsets.

It is proposed that a Fund payment would be made if the like-for-like or variation credits are not available during, or at the end of, the EOI period.

As the biodiversity credits required for offsetting the project presented herein have been calculated according to the FBA, it will be necessary (following approval of the SSD application) to submit an application to the Biodiversity Conservation Trust to have the credits converted into an equivalent number of BAM credits[4]. Upon receipt of the 'statement of equivalence' from the Trust, the proponent can then apply to the Trust pay the required monetary value into the Biodiversity Conservation Fund.

7.8 Preferred Offsetting Option

7.8.1 Proposed Offset Site – Generate Credits for Offsetting

The proposed Offset Site is the northern portion of Lot DP 574308. The site is located immediately north of the proposed quarry expansion area is approximately 49 ha and occupies low lying land containing swampy vegetation types and open cleared grassland that is used for cattle grazing.

Native Vegetation on the Offset Site

Vegetation mapping for the Port Macquarie-Hastings LGA (Phillips *et al.* 2013) was applied to develop a preliminary vegetation map for the Offset Site. The vegetation types mapped by Phillips *et al.* (2013) within the Offset Site are shown in **Figure 10** and the mapped areas are listed in **Table 26**.

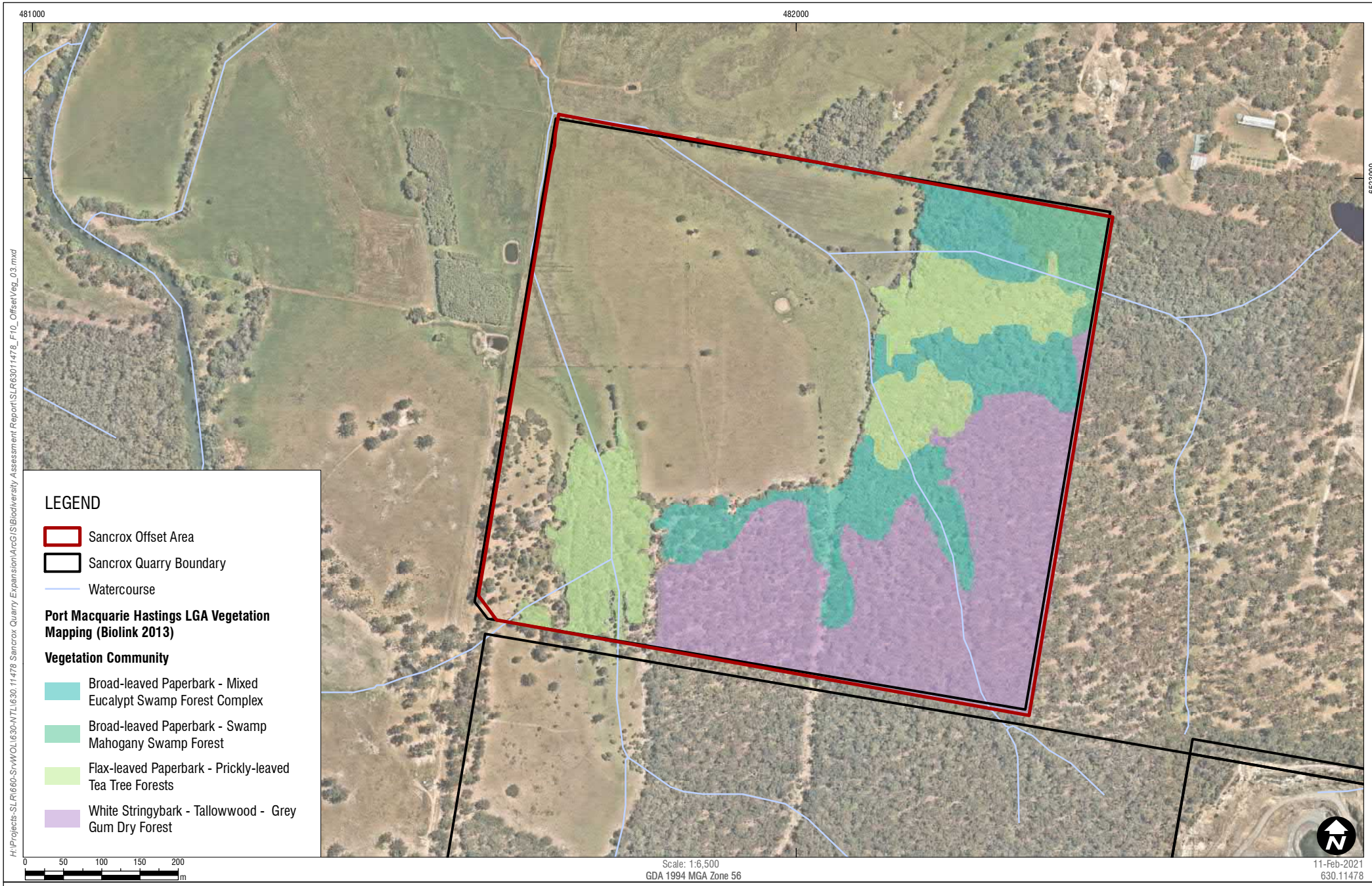
Table 26 Vegetation types mapped within the Offset site

Code	Broad Vegetation Type #	Area (ha)
PMVC_062	Broad-leaved Paperbark – Mixed Eucalypt Swamp Forest Complex	12.3
PMVC_063	Broad-leaved Paperbark – Swamp Mahogany Swamp Forest	1.3
PMVC_037	White Stringybark - Tallowwood - Grey Gum Dry Forest	12.3
PMVC_062	Broad-leaved Paperbark – Mixed Eucalypt Swamp Forest Complex	23.1
	Total	**49**

Source: Phillips *et al.* (2013)

The Council vegetation types were converted into PCTs according to the BioNet Vegetation Classification database. The equivalent PCTs mapped within the Offset Site, including vegetation formation and vegetation class, are listed in **Table 27.**

[4] If a development proponent holds an offset obligation that was calculated using the BioBanking Assessment Methodology (BBAM) or Framework for Biodiversity Assessment (FBA), they will need to seek a 'statement of reasonable equivalence of biodiversity credits' from the Department of Planning, Industry and Environment (DPIE) before paying into the Biodiversity Conservation Fund.



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Data Source: NSW SS 2020
Aerial imagery supplied by Nearmap (November, 2020)

Council Vegetation Mapping within Proposed Offset Area

FIGURE 10

Table 27 PCTs, Formations and Classes Mapped within the Offset Site

Veg Formation	Veg Class	PCT Code	PCT Name	Area (ha)
Forested Wetlands	Coastal Swamp Forests	1064	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	35.4
Forested Wetlands	Coastal Swamp Forests	1230	Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	1.3
Dry Sclerophyll Forests (grassy)	Hunter-Macleay Dry Sclerophyll Forests	1548	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	12.3
			Total Area (ha)	**49**

An indicative map of PCTs within the Offset Site is presented in **Figure 11.** It is noted that only one of the PCTs mapped within the Offset Site, *Tallowwood - Small-fruited Grey Gum dry grassy open forest* (NR263), also occurs within the Development Site.

Ecosystem Credits

Based on Council vegetation mapping, vegetation zones have been identified within the Offset Site and are shown in **Figure 12**. A Stewardship Agreement will be placed over the Offset Site to generate part of the credit requirement for the Development. The following tasks were completed to estimate the likely ecosystem credits that would be created in a Stewardship Site:

- Application of the *BioBanking Assessment Methodology 2014* (BBAM 2014; OEH 2014b);
- Landscape value calculations using available vegetation mapping, aerial imagery and GIS techniques, as per the BBAM 2014;
- Calculation of site value score in the Credit Calculator using benchmark data for each PCT (noting that no plot data has been collected from the Offset Site); and
- Assuming standard rehabilitation and site management would be applied, with commensurate uplift in site value score in the Credit Calculator.

The ecosystem credits that have been estimated in the Credit Calculator for the Offset Site are listed in **Table 28**. It should be noted that the ecosystem credit estimates for the Offset Site will need to be re-calculated according to the BAM, including preparation of a Biodiversity Stewardship Site Assessment Report (BSSAR) following approval of the SSD Application to allow creation of a Stewardship Site and the associated credits.

Table 28 Ecosystem Credits potentially created in the Proposed Offset Site

PCT	Biometric Code	Vegetation type name	BBAM Credits Created
1064	NR217	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	353
1230	NR254	Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	14
1548	NR263	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	135
		Total	**502**

Species Credits

The three PCTs within the proposed Offset Site (see **Table 27**) all contain Koala feed trees; accordingly the forested parts of the site contains around 26.9 ha of Koala habitat. On this basis, Koala species credits have been calculated for the Offset Site using the BioBanking method, although it is noted that targeted surveys for the Koala have not been conducted as part of this BAR. On this basis, the proposed Offset Site could generate 191 Koala species credits.

Targeted surveys for other threatened species credit species identified in the Credit Calculator have not been completed as part of this BAR, but would be considered as part of a future application for a Stewardship Agreement.

7.8.2 Offset Strategy Proposed

The preferred offsetting option for the proposed development is a combination of Options 1a and 1b, being:

Ecosystem credits:

- Generate available ecosystem credits from the proposed Offset Site – create a Stewardship Agreement under the BC Act. This action will only provide some of the ecosystem credits required, as per **Table 29**.
- Purchase like-for-like ecosystem credits from Credit Register (or approach potential credit sellers through the Expressions of Interest register).
- Purchase 'variation credits' by applying the variation rules under the FBA, in the scenario that like-for-like credit cannot be found after completing "reasonable steps". In this regard, an Expression of Interest for the required ecosystem credits will be published on the OEH BioBanking 'Credits Wanted' register.
- Pay the monetary of the remaining credit obligation into the BCF.

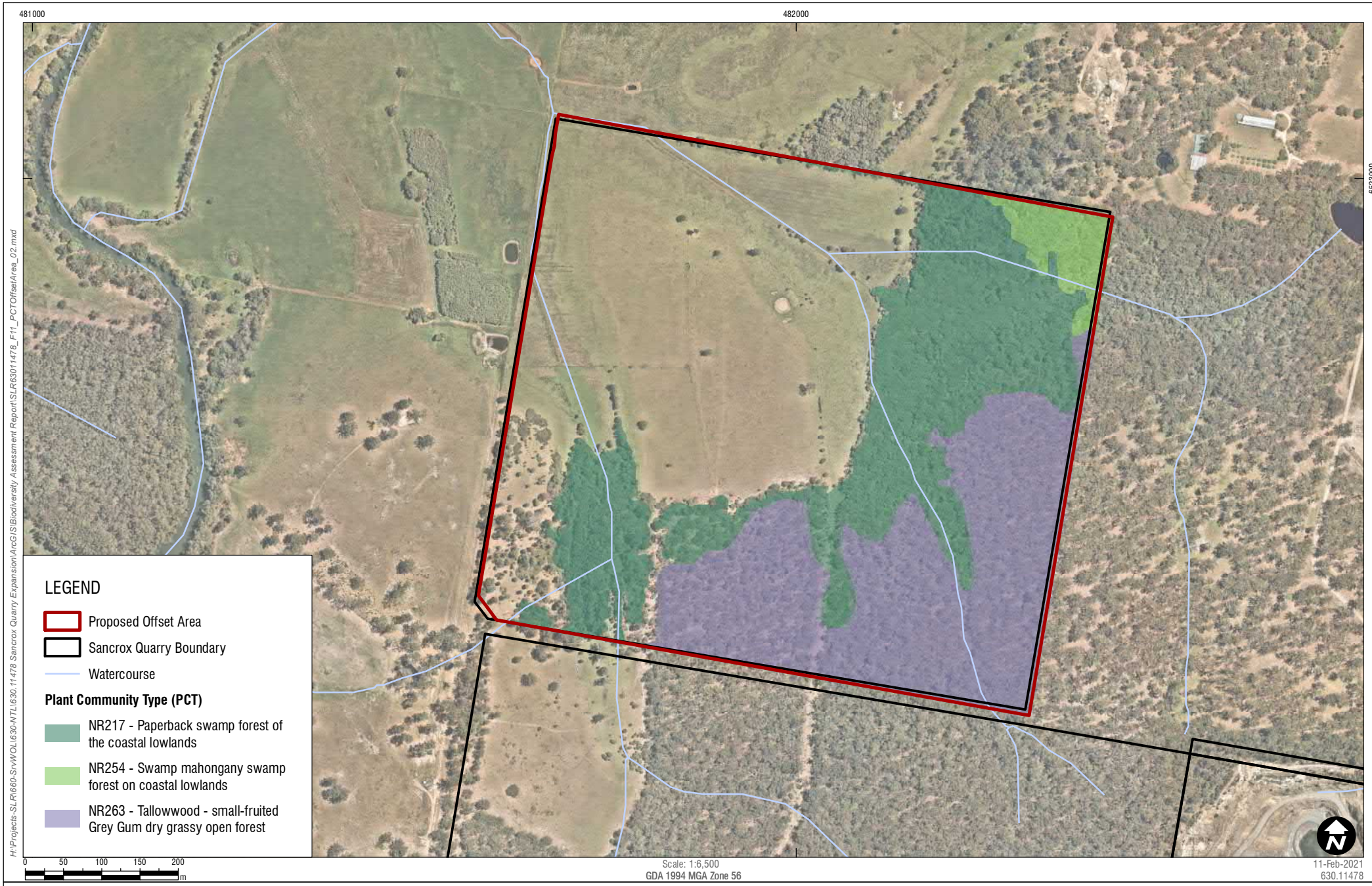
Species credits:

- Generate available Koala species credits from the proposed Offset Site by establishing a Stewardship Agreement under the BC Act. This action will provide some of the species credits required, as per **Table 29**.
- Purchase Koala species credits from the BioBanking or BAM credit registers; and/or:

- Pay the equivalent monetary value (as calculated using the BOPC[5]) into the Biodiversity Conservation Fund

Under the NSW Biodiversity Offsets Scheme (BOS), development proponents may choose to pay into the Biodiversity Conservation Fund as an alternative to retiring biodiversity credits to meet their project offset obligation.

[5] Biodiversity Offsets Payment Calculator



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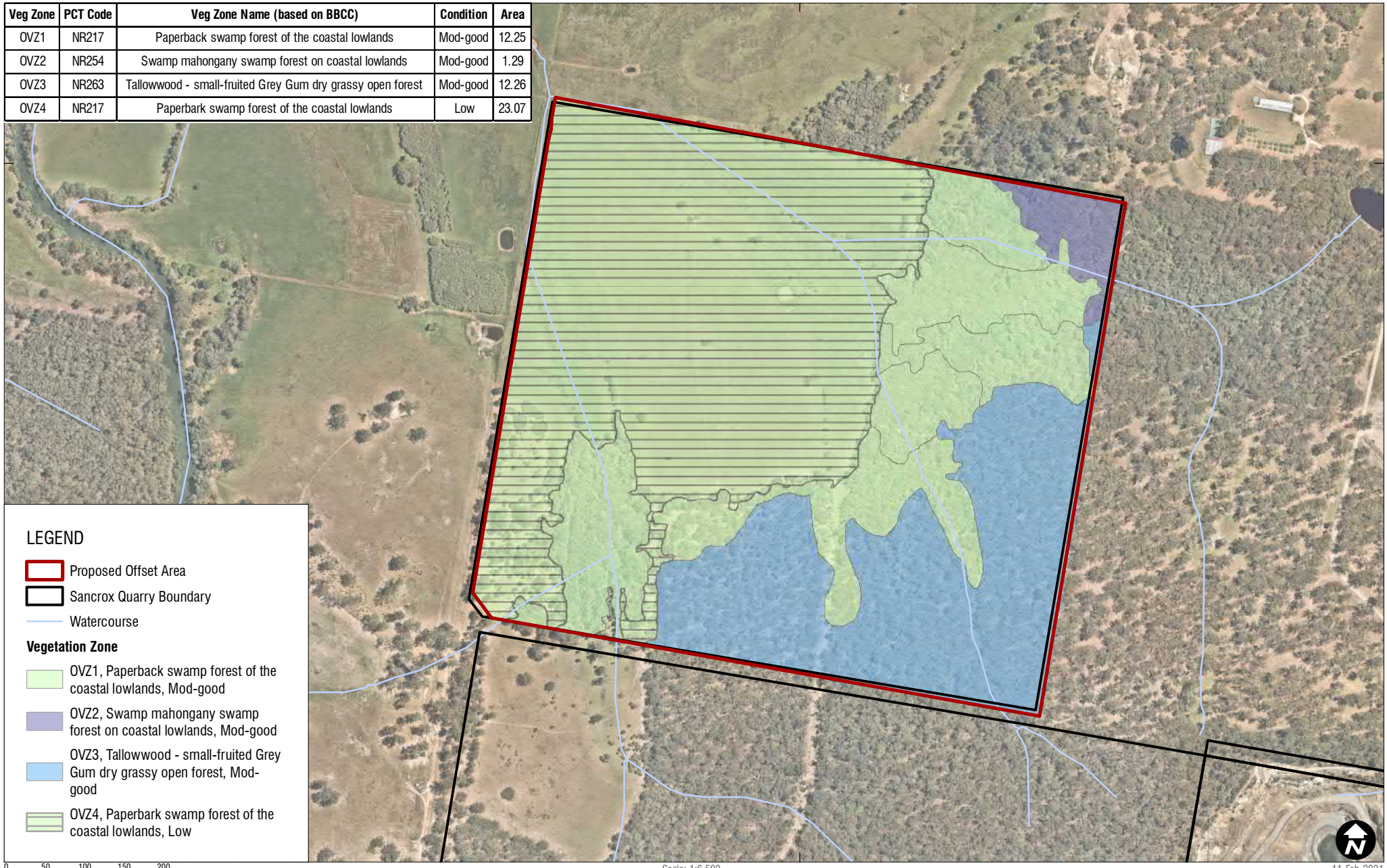
Data Source: NSW SS 2020
Aerial imagery supplied by Nearmap (November, 2020)

Plant Community Types (PCTs) - Within Proposed Offset Area

FIGURE 11

Veg Zone	PCT Code	Veg Zone Name (based on BBCC)	Condition	Area
OVZ1	NR217	Paperback swamp forest of the coastal lowlands	Mod-good	12.25
OVZ2	NR254	Swamp mahongany swamp forest on coastal lowlands	Mod-good	1.29
OVZ3	NR263	Tallowwood - small-fruited Grey Gum dry grassy open forest	Mod-good	12.26
OVZ4	NR217	Paperbark swamp forest of the coastal lowlands	Low	23.07



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Data Source: NSW SS 2020
Aerial imagery supplied by Nearmap (November, 2020)

Vegetation Zones - Within Proposed Offset Area

FIGURE 12

A comparison of the ecosystem credits required for offsetting the proposed development and those potentially available in the Offset Site is provided in **Table 29** .

Table 29 Biodiversity Credit Balance – Credits Required vs Credits Generated in Offset

Biometric Code	Vegetation Type Name	FBA Credits Required	Credits in Offset	Remaining Credits to Purchase
NR247	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	505	0	505
NR263	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	1725	135	1590
NR254	Swamp Mahogany swamp forest on coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion	0	14	0
NR217	Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	0	353	0
	Koala Species Credits	1,015	191	824

The ecosystem credits that form the offset obligation for the proposed development, as listed in **Table 29**, would either be sourced from the Offset Site and/or purchased from the BioBanking Credit Register (if available), with remainder converted into a monetary value using the BOPC and that value paid into the Biodiversity Conservation Fund. As the number and type of credits that will be available for purchase from the credit register following development approval is not known, the final payment into the Fund will be determined at the completion of the EOI period.

A total of 1,015 Koala species credits are required for offsetting the proposed development, and around 191 could be generated in the Offset Site. This would leave a balance of 824 species credits still required to be purchased (and retired) or an equivalent BCF payment (**Table 29**).

It is important to note that targeted threatened species surveys have not been conducted in the proposed Offset Site; however, given the habitats and vegetation type present, it is likely that one or more threatened species could be present. Hence, the Offset Site is likely to generate the some species credit types, although this will need to be confirmed through targeted surveys (during the appropriate season) as part of any future Stewardship Agreement application. For the purposes of this BOS, the number of species credits available in the Offset Site is presumed to be zero.

An Expression of Interest (EOI), listing the biodiversity credits required for offsetting the proposed development, will be published prior to finalisation of the BAR to commence the process of obtaining the required like-for-like credits. At the completion of the six month exhibition period, the proponent will have completed the 'reasonable steps' and may choose to seek other credit types under the variation rules.

7.8.3 Offset Strategy Actions

Actions proposed to fulfil the offset requirement for the project will involve:

- Subject to receipt of Minister's Conditions of Approval, apply to the Biodiversity Conservation Trust to have the ecosystem credits presented in this BAR converted into an equivalent number of BAM credits;
- Uploading an EOI for the required biodiversity credits on the 'Credit Wanted' register of the BioBanking Credit Register;

- Monitor the availability of matching ecosystem credits during the six month advertisement period (as required by OEH), including regularly checking the credit register for credits that match the required type and number of credits for the project (**Table 24**);
- During, or at the end of, the advertisement (EOI) period, either:
  - Purchase like-for-like credits or if not available purchase variation credits; if neither like-for-like nor variation credit types available, then:
  - pay fund deposit into Biodiversity Conservation Fund (calculated using BOPC).

8 EPBC ACT Matters

This chapter identifies matters of national environmental significance listed under the EPBC Act that are of potential relevance to the proposed development.

8.1 Predicted Matters of NES

The PMST database provides an indicative list of matters of national environmental significance (matters of NES) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). A copy of the PMST results is provided in **Appendix K**. The PMST results indicate the following matters (and/or or their habitats) are either present or are predicted to occur within the locality:

- 62 threatened species;
- 56 listed migratory species;
- three listed threatened ecological communities; and
- no wetlands of international importance (Ramsar Wetlands).

Of the above listed matters of NES that are predicted to occur within the locality of the site, those of potential relevance to the site and the proposed development are discussed in the following sections.

8.2 Relevant Matters of NES

8.2.1 Listed Threatened Species

The 62 threatened species (and/or their habitats) listed under the EPBC Act that are predicted to occur within the locality comprise 29 bird species, one fish species, eight mammal species, five reptile species, three amphibian, one insect and 15 plant species (**Appendix K**). These species and their legal status within NSW and at a national level are listed in **Table 30**.

Table 30 PMST Results – Listed Threatened Species

Common Name	Scientific Name	EPBC Act Listing	BC Act Listing
Regent Honeyeater	*Anthochaera phrygia*	Critically Endangered	Critically Endangered
Australasian Bittern	*Botaurus poiciloptilus*	Endangered	Endangered
Red Knot, Knot	*Calidris canutus*	Endangered	Not Listed
Curlew Sandpiper	*Calidris ferruginea*	Critically Endangered	Endangered
Lesser Sand Plover, Mongolian Plover	*Charadrius mongolus*	Endangered	Vulnerable
Eastern Bristlebird	*Dasyornis brachypterus*	Endangered	Endangered
Antipodean Albatross	*Diomedea antipodensis*	Vulnerable	Vulnerable
Gibson's Albatross	*Diomedea antipodensis gibsonii*	Vulnerable	Vulnerable
Southern Royal Albatross	*Diomedea epomophora (sensu stricto)*	Vulnerable	Not Listed
Wandering Albatross	*Diomedea exulans (sensu lato)*	Vulnerable	Endangered
Northern Royal Albatross	*Diomedea sanfordi*	Endangered	Not Listed

Common Name	Scientific Name	EPBC Act Listing	BC Act Listing
Red Goshawk	*Erythrotriorchis radiatus*	Vulnerable	Critically Endangered
Painted Honeyeater	*Grantiella picta*	Vulnerable	Vulnerable
Swift Parrot	*Lathamus discolor*	Critically Endangered	Endangered
Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit	*Limosa lapponica baueri*	Vulnerable	Not Listed
Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit)	*Limosa lapponica menzbieri*	Critically Endangered	Not Listed
Southern Giant-Petrel, Southern Giant Petrel	*Macronectes giganteus*	Endangered	Endangered
Northern Giant Petrel	*Macronectes halli*	Vulnerable	Vulnerable
Eastern Curlew, Far Eastern Curlew	*Numenius madagascariensis*	Critically Endangered	Not Listed
Fairy Prion (southern)	*Pachyptila turtur subantarctica*	Vulnerable	Not Listed
Australian Painted Snipe	*Rostratula australis*	Endangered	Endangered
Buller's Albatross, Pacific Albatross	*Thalassarche bulleri*	Vulnerable	Not Listed
Northern Buller's Albatross, Pacific Albatross	*Thalassarche bulleri platei*	Vulnerable	Not Listed
Shy Albatross, Tasmanian Shy Albatross	*Thalassarche cauta cauta*	Vulnerable	Vulnerable
White-capped Albatross	*Thalassarche cauta steadi*	Vulnerable	Not Listed
Chatham Albatross	*Thalassarche eremita*	Endangered	Not Listed
Campbell Albatross, Campbell Black-browed Albatross	*Thalassarche impavida*	Vulnerable	Not Listed
Black-browed Albatross	*Thalassarche melanophris*	Vulnerable	Vulnerable
Salvin's Albatross	*Thalassarche salvini*	Vulnerable	Not Listed
Black Rockcod, Black Cod, Saddled Rockcod	*Epinephelus daemelii*	Vulnerable	Not Listed
Green and Golden Bell Frog	*Litoria aurea*	Vulnerable	Endangered
Stuttering Frog, Southern Barred Frog	*Mixophyes balbus*	Vulnerable	Endangered
Giant Barred Frog, Southern Barred Frog	*Mixophyes iteratus*	Endangered	Endangered
Australian Fritillary	*Argynnis hyperbius inconstans*	Critically Endangered	Endangered
Large-eared Pied Bat, Large Pied Bat	*Chalinolobus dwyeri*	Vulnerable	Vulnerable
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population)	*Dasyurus maculatus maculatus (*SE mainland population)	Endangered	Vulnerable
Greater Glider	*Petauroides volans*	Vulnerable	Not Listed
Brush-tailed Rock-wallaby	*Petrogale penicillata*	Vulnerable	Endangered

Common Name	Scientific Name	EPBC Act Listing	BC Act Listing
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory)	*Phascolarctos cinereus* (combined populations of Qld, NSW and the ACT)	Vulnerable	Vulnerable
Long-nosed Potoroo (SE mainland)	*Potorous tridactylus tridactylus*	Vulnerable	Vulnerable
New Holland Mouse, Pookila	*Pseudomys novaehollandiae*	Vulnerable	Not Listed
Grey-headed Flying-fox	*Pteropus poliocephalus*	Vulnerable	Vulnerable
Scented Acronychia	*Acronychia littoralis*	Endangered	Endangered
Dwarf Heath Casuarina	*Allocasuarina defungens*	Endangered	Endangered
	Allocasuarina thalassoscopica	Endangered	Not Listed
Hairy-joint Grass	*Arthraxon hispidus*	Vulnerable	Vulnerable
Trailing Woodruff	*Asperula asthenes*	Vulnerable	Vulnerable
Leafless Tongue-orchid	*Cryptostylis hunteriana*	Vulnerable	Vulnerable
White-flowered Wax Plant	*Cynanchum elegans*	Endangered	Endangered
	Euphrasia arguta	Critically Endangered	Critically Endangered
	Hakea archaeoides	Vulnerable	Vulnerable
Macadamia Nut	*Macadamia integrifolia*	Vulnerable	Not Listed
Biconvex Paperbark	*Melaleuca biconvexa*	Vulnerable	Vulnerable
Milky Silkpod	*Parsonsia dorrigoensis*	Endangered	Vulnerable
Lesser Swamp-orchid	*Phaius australis*	Endangered	Endangered
Magenta Lilly Pilly	*Syzygium paniculatum*	Vulnerable	Endangered
Austral Toadflax	*Thesium australe*	Vulnerable	Vulnerable
Loggerhead Turtle	*Caretta caretta*	Endangered	Endangered
Green Turtle	*Chelonia mydas*	Vulnerable	Vulnerable
Leatherback Turtle	*Dermochelys coriacea*	Endangered	Endangered
Hawksbill Turtle	*Eretmochelys imbricata*	Vulnerable	Not Listed
Flatback Turtle	*Natator depressus*	Vulnerable	Not Listed

Most of the species listed in **Table 30** are also listed under the BC Act and therefore are considered in Chapter 4 of this report, as well as in the likelihood of occurrence table in **Appendix G**.

Many of the EPBC Act listed species in **Table 30** are marine birds (21) or marine reptiles (i.e. five turtles). Being located inland from the coast, the site at Sancrox is of no relevance to marine species. The single threatened fish species, the Black Rockcod, is a marine species that occurs in rocky reef and inshore areas along the NSW coast. It is therefore not relevant to the site at Sancrox.

With regard to the EPBC Act listed threatened species that are not predicted to occur in the Credit Calculator or the NSW Wildlife Atlas:

- They are not predicted to occur in the Credit Calculator and therefore not likely to occur (i.e. suitable vegetation or habitat features is not present or their distributional range lies outside of the IBRA subregion); or

- They have not been recorded on the Wildlife Atlas within the locality.

The study area contains suitable foraging habitat for the Swift Parrot and Regent Honeyeater, in the form of winter flowering gums, such as Spotted Gum and Swamp Mahogany (which occurs in the Offset Site). Both species breed elsewhere in Australia (the Swift Parrot in Tasmania and the Regent Honeyeater in certain parts of central NSW) but migrate to coastal NSW during winter to feed on winter-flowering tree species. Accordingly, individual Regent Honeyeaters and Swift Parrots may utilise the site for foraging purposes seasonally during winter, although the site would not form a large or important area of winter forage for these species. As the Swift Parrot breeds in Tasmania and the Regent Honeyeater breeds elsewhere in NSW, the Development Site does not contain breeding habitat for these two species.

Similarly, the forest habitat across the Development Site represents potential foraging habitat for the Grey-headed Flying Fox, Spotted-tail Quoll, Koala, Greater Glider, Large-eared Pied Bat, Painted Honeyeater and Long-nosed Potoroo. These species are addressed in Chapter 4.

8.2.2 Listed Threatened Communities

The listed threatened communities that have been recorded or are predicted to occur within the locality (**Appendix K**) include:

- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community;
- Lowland Rainforest of Subtropical Australia; and
- Subtropical and Temperate Coastal Saltmarsh;

None of these listed threatened communities is present within the study area.

8.2.3 Wetlands of National Significance

No Wetlands of International Importance or of National Significance were identified within the 10 km radius of the study area.

8.2.4 Migratory species

A total of 56 migratory species (and/or their habitats) are predicted to occur within the locality, 22 of which are wetland species (**Appendix K**). A total of 18 migratory marine birds are predicted to occur within the locality as well as 10 migratory marine species. The remaining six species are terrestrial and include the White-throated Needletail, Satin Flycatcher, Oriental Cuckoo, Black-faced Monarch, Spectacled Monarch and Rufous Fantail.

The study area does not contain suitable habitat for the listed wetland species, with the exception that large or sustained rainfall events could create periodic and temporary soaks or ponds within the low lying parts of the Development Site. Regardless of this, due to their large ranges, such species would not be dependent on the study area (if they use it at all) for foraging, breeding or other life cycle processes.

The terrestrial species all occupy a large variety of habitats and similarly have very large ranges. The vegetation within the study area does not constitute 'important habitat' for such species, as defined by DoE (2013), most of which utilise more intact and structurally complex woodlands.

The study area does not contain suitable habitat for the listed marine species. The only open water within the subject area is a retention dam which does not provide suitable habitat for the listed species. The site contains only relatively small first order steams which traverse the site. These watercourses do not provide suitable habitat or foraging area for the listed species.

8.3 Impacts on Relevant Matter of NES

8.3.1 Listed Threatened Species

The threatened species identified in **Section 8.2** have been considered in accordance with the 'significant impact criteria' for 'vulnerable' and 'endangered' species in the *Significant Impact Guidelines 1.1* (DoE 2013).

Taking into consideration all stages and components of the proposal, and all related activities and infrastructure, there is the potential for impacts, including indirect impacts, on matters of national environmental significance, being mainly loss of a potential foraging habitat for mobile threatened fauna species, including birds, bats and mammals. However, it is highly unlikely that any of such species will be adversely impacted by the proposal, because:

- suitable breeding habitat for most of the species is absent within the study area. For those species that have either been recorded or could utilise the habitats within the study area, there are not likely to be local populations present wholly within the study area or reliant on the study area for their survival in isolation. Any such populations present within the locality will not be rendered locally extinct by the proposed development. This is based on the large ranges of these species, the poor quality and condition of the habitats present within the study area.
- the study area is not assessed as likely to contain habitat critical to the survival of a species;
- the study area is not likely to support an 'important population' (as defined by DoE 2015) of any threatened species; and
- the proposed mitigation measures (see **Section 5.5**) will mitigate or reduce impacts on threatened species.

With reference to the criteria for vulnerable and endangered species, the proposal is not likely to:

- lead to a long-term decrease in the size of an important population of a species;
- reduce the area of occupancy of an important population;
- fragment an existing important population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of an important population;
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that a species is likely to decline;
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;
- introduce disease that may cause a species to decline; or
- interfere substantially with the recovery of any of these species.

8.3.2 Migratory species

The study area contains no habitat for the 22 listed migratory wetland species and only marginal habitat for the six listed terrestrial migratory species predicted to occur in the locality (**Appendix K)**.

In regard to the terrestrial migratory species, the forested and open areas of the site represent potential foraging habitat. It is theoretically possible that these highly mobile species could utilise the subject temporarily during foraging, dispersal or migration. Conversely, the study area constitutes only a relatively small proportion of the large ranges of these species and does not contain breeding habitat for these species.

With reference to the criteria for migratory species in the *Significant Impact Guidelines 1.1*, the study area does not contain an area of 'important habitat' for any migratory species. Furthermore, the proposal is highly unlikely to disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. Hence the proposal is not likely to have a significant impact on any listed migratory species under the EPBC Act.

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APPENDIX A

SEARS (Biodiversity)

Planning Services
Resource Assessments
Contact: Anthony Barnes
Phone: 8289 6709
Email: anthony.barnes@planning.nsw.gov.au

Matt Errington
Principal Environmental Consultant
Environmental Resources Management Australia
Locked Bag 3012 Australia Square
NSW 1215

Dear Mr Errington

Reissue of State Significant Development - Secretary's Requirements
Sancrox Quarry Extension Project (SSD 7293)

I have enclosed updated Secretary's requirements for the preparation of an Environmental Impact Statement (EIS) for the Sancrox Quarry Extension Project which replace the Secretary's requirements issued on 19 October 2015.

These requirements are based on the information you have previously provided, and reflect previous consultation with relevant government agencies.

Your attention is drawn to the environmental planning instruments (EPI), policies and guidelines to be addressed in your EIS (see Attachment 1). Please note that where these EPIs, guidelines and policies have changed or been updated, your EIS will need to address the latest available version.

The agencies' previous comments are attached for your information (see Attachment 2). You must have regard to these comments in the preparation of the EIS.

Please note that the Department may alter these requirements at any time, and that you must consult further with the Department if you do not lodge a development application and EIS for the project within the next two years.

You should establish whether the proposal requires a separate approval under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as soon as possible. If such an approval is required, please notify the Department immediately, as the Commonwealth approval process is likely to be integrated with the NSW approval process (under the bilateral agreement), and supplementary requirements will need to be issued.

Please contact the Department at least two weeks before you plan to submit the development application and EIS for the project. This will enable the Department to:

- confirm the applicable fee (see Division 1AA, Part 15 of the *Environmental Planning and Assessment Regulation 2000*); and
- determine the required number of copies of the EIS (hard copy and digital).

It is important for you to recognise that the Department will review the EIS for the project carefully before putting it on public exhibition. If it fails to adequately address these requirements, then you will be required to submit an amended EIS.

If you have any enquiries about these requirements, please contact Anthony Barnes on the details listed above.

Yours sincerely

Howard Reed

Howard Reed 18.9.17
Director
Resource Assessments
as the Secretary's delegate

Secretary's Environmental Assessment Requirements

State Significant Development

Section 78A(8A) of the *Environmental Planning and Assessment Act 1979*
Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*

Application Number	SSD 7293
Proposal	The Sancrox Quarry Extension Project, which involves: • extending the approved extraction boundary by approximately 52 hectares, • extending the quarry life by ten years (from 20 to 30 years), • increasing the production limit from 455,000 tonnes per annum (tpa) to 750,000 tpa, • constructing and operating a concrete batching plant producing 20,000m^3 per annum (p/a), • constructing and operating a concrete recycling facility processing 20,000 tonnes p/a, • increasing truck movements and equipment loading from 7am–11pm weekdays, and 7am–1pm weekends and public holidays to 24 hours per day 7 days per week, • increasing quarry operations from 7am–5pm weekdays, and 7am–1pm Saturday to 24 hours per day 7 days per week, • transporting material off-site via public roads; and • Constructing and operating an asphalt plant producing 50,000 tonnes per annum.
Location	Sancrox Road Sancrox, Lot 2 DP 574308 Lot 353 DP 754434 Lot 1 DP 704890 Lot 1 DP 720807
Applicant	Hanson Construction Materials Pty Ltd (Hanson)
Date of Issue	18 September 2017
General Requirements	The Environmental Impact Statement (EIS) for the development must comply with the requirements in Clauses 6 and 7 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000.* In particular, the EIS must include: • a stand-alone executive summary; • a full description of the development, including: – the resource to be extracted, including the amount, type and composition; – the site layout and extraction plan, including cross-sectional plans; – the production process and processing activities, including the in-flow and out-flow of materials and points of discharge to the environment; – surface infrastructure and facilities (including any infrastructure that would be required for the development, but the subject of a separate approvals process); – a waste (overburden, rejects, tailings etc) management strategy; – a water management strategy; – a rehabilitation strategy to apply during, and after completion of, extraction operations, and proposed final use of site; and – the likely interactions between the development and any existing, approved or proposed development in the vicinity of the site; • a strategic justification of the development focusing on site selection and the suitability of the proposed site; • a list of any approvals that must be obtained before the development may

	commence; • an assessment of the likely impacts of the development on the environment, focussing on the key issues identified below, including: – a description of the existing environment likely to be affected by the development, using sufficient baseline data; – an assessment of the likely impacts of all stages of the development, including any cumulative impacts, taking into consideration any relevant laws, environmental planning instruments, guidelines, policies, plans and industry codes of practice; – a description of the measures that would be implemented to avoid, minimise, mitigate and/or offset the likely impacts of the development, and an assessment of: o whether these measures are consistent with industry best practice, and represent the full range of reasonable and feasible mitigation measures that could be implemented; o the likely effectiveness of these measures; and o whether contingency measures would be necessary to manage any residual risks; and – a description of the measures that would be implemented to monitor and report on the environmental performance of the development; • a consolidated summary of all the proposed environmental management and monitoring measures, identifying all the commitments in the EIS; • consideration of the development against all relevant environmental planning instruments (including Part 3 of the *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007)*; • the reasons why the development should be approved, having regard to: - relevant matters for consideration under the *Environmental Planning and Assessment Act 1979*, including the objects of the Act; - the biophysical, economic and social impacts of the project, including the principles of ecologically sustainable development; - the suitability of the site with respect to potential land use conflicts with existing and future surrounding land uses; - feasible alternatives to the development (and its key components), including the consequences of not carrying out the development; • a signed declaration from the author of the EIS, certifying that the information contained within the document is neither false nor misleading. While not exhaustive, Attachment 1 contains a list of some of the environmental planning instruments, guidelines, policies, and plans that may be relevant to the environmental assessment of this development. In addition to the matters set out in Schedule 1 of the *Environmental Planning and Assessment Regulation 2000*, the development application must be accompanied by a signed report from a suitably qualified expert that includes an accurate estimate of the capital investment value (as defined in Clause 3 of the *Environmental Planning and Assessment Regulation 2000*) of the development, including details of all the assumptions and components from which the capital investment value calculation is derived.
Key Issues	The EIS must address the following key issues: • **Noise & Blasting** – including: - a detailed assessment of the likely construction, operational and off-site transport noise impacts of the development in accordance with the *Interim Construction Noise Guideline*, *NSW Industrial Noise Policy* and the *NSW Road Noise Policy* respectively, and having regard to the *Voluntary Land Acquisition and Mitigation Policy*; - if a claim is made for specific construction noise criteria for certain activities, then this claim must be justified and accompanied by an assessment of the likely construction noise impacts of these activities under the *Interim Construction Noise Guideline*; - proposed blasting hours, frequency and methods; - a detailed assessment of the likely blasting impacts of the development (including noise, vibrations, overpressure, visual and odour) on people,

	animals, buildings, infrastructure and significant natural features, having regard to the relevant ANZEC guidelines; - reasonable and feasible mitigation measures to minimise noise emissions; and - monitoring and management measures, in particular real-time and attended noise monitoring; • **Air Quality** – including: - a detailed assessment of potential construction and operational impacts, in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW,* and with a particular focus on dust emissions including $PM_{2.5}$ and PM_{10}, and having regard to the *Voluntary Land Acquisition and Mitigation Policy*; - an assessment of potential dust and other emissions generated from processing, operational activities and transportation of quarry products; - reasonable and feasible mitigation measures to minimise dust and emissions; and - monitoring and management measures, in particular, real-time air quality monitoring; • **Water** – including: - a detailed site water balance, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures; - identification of any licensing requirements or other approvals under the *Water Act 1912* and/or *Water Management Act 2000*; - demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP); - a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant WSP or water source embargo; - an assessment of any likely flooding impacts of the development; - an assessment of the likely impacts on the quality and quantity of existing surface and ground water resources, including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives; - an assessment of the likely impacts of the development on aquifers, watercourses, riparian land, water-related infrastructure, and other water users; and - a detailed description of the proposed water management system (including sewage), water monitoring program and other measures to mitigate surface and groundwater impacts; • **Biodiversity** – including: - accurate predictions of any vegetation clearing on site; - a detailed assessment of the likely biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems, and having regard to the *NSW Biodiversity Offsets Policy for Major Projects* and the *Framework for Biodiversity Assessment*; and - a strategy to offset any residual impacts of the development in accordance with the *NSW Biodiversity Offsets Policy for Major Projects*, including evidence that the appropriate type and quantum of offsets will be available; • **Heritage** – including: - an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage; and - identification of historic heritage in the vicinity of the development and an assessment of the likelihood and significance of impacts on heritage items, having regard to the relevant policies and guidelines listed in

	Attachment 1; • **Traffic & Transport** – including: - accurate predictions of the road traffic generated by the construction and operation of the development, including a description of the types of vehicles likely to be used for transportation of quarry products; - a detailed assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and State road network (as identified above), including a road safety audit; and - a description of the measures that would be implemented to mitigate any impacts, including concept plans of any proposed upgrades, developed in consultation with the relevant road and rail authorities (if required); • **Land Resources** – including a detailed assessment of: - potential impacts on soils and land capability (including potential erosion and land contamination) and the proposed mitigation, management and remedial measures (as appropriate); - potential impacts on landforms (topography), paying particular attention to the long term geotechnical stability of any new landforms (such as overburden dumps, bunds etc); and - the compatibility of the development with other land uses in the vicinity of the development in accordance with the requirements in Clause 12 of *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries)* 2007, paying particular attention to the agricultural land use in the region; • **Waste –** including estimates of the quantity and nature of the waste streams that would be generated or received by the development and any measures that would be implemented to minimise, manage or dispose of these waste streams; • **Hazards –** including an assessment of the likely risks to public safety, paying particular attention to the transport, handling and use of any hazardous or dangerous goods; • **Visual** – including a detailed assessment of the likely visual impacts of the development on private landowners in the vicinity of the development and key vantage points in the public domain, paying particular attention to any new landforms, and to minimising the lighting impacts of the development; • **Social & Economic** – including: - a detailed assessment of the likely social impacts of the development on the local and regional community in accordance with the *Social impact assessment guideline for State significant mining, petroleum production and extractive industry development*; and - a detailed assessment of the likely economic impacts of the development, paying particular attention to: o the significance of the resource; o the costs and benefits of the project; identifying whether the development as a whole would result in a net benefit to NSW, including consideration of fluctuation in commodity markets and exchange rates; and o the demand for the provision of local infrastructure and services; and • **Rehabilitation** – including the proposed rehabilitation strategy for the site having regard to the key principles in the *Strategic Framework for Mine Closure*, including: - rehabilitation objectives, progressive rehabilitation commitments, methodology, monitoring programs, performance standards and proposed completion criteria; - nominated final land use, having regard to any relevant strategic land use planning or resource management plans or policies; and - the potential for integrating this strategy with any other rehabilitation and/or offset strategies in the region.
Consultation	During the preparation of the EIS, you must consult with relevant local, State and Commonwealth Government authorities, service providers, Aboriginal stakeholders, community groups and affected landowners. You must:

	• consult with: - affected landowners; - community groups; - Port Macquarie-Hastings Council; - Office of Environment and Heritage (including the Heritage Branch); - Environment Protection Authority; - Division of Resources and Geoscience within the Department; - Department of Primary Industries (including the DPI Water, NSW Forestry, Agriculture and Fisheries sections and Crown Lands division); - North Coast Local Land Services; - Roads and Maritime Services; - NSW Rural Fire Service; and • establish a Community Consultative Committee for the project in accordance with the *Community Consultative Committee Guidelines for State Significant Projects,* and consult with the committee during the preparation of the EIS.
Further consultation after 2 years	If you do not lodge a development application and EIS for the development within 2 years of the issue date of these requirements, you must consult further with the Secretary in relation to the preparation of the EIS.

ATTACHMENT 1

Environmental Planning Instruments, Policies, Guidelines & Plans

Air	
	Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments (DP&E)
	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (EPA)
	Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System for Inclusion into the 'Approved Methods for the Modelling and Assessments of Air Pollutants in NSW, Australia'
	National Greenhouse Accounts Factors (Commonwealth)
Noise & Blasting	
	Voluntary Land Acquisition and Mitigation Policy for State Significant Mining, Petroleum and Extractive Industry Developments (DP&E)
	NSW Industrial Noise Policy (EPA)
	Interim Construction Noise Guideline (DECC)
	NSW Road Noise Policy (EPA)
	Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZEC)
Water	
Groundwater	NSW State Groundwater Policy Framework Document (NOW)
	NSW State Groundwater Quality Protection Policy (NOW)
	NSW State Groundwater Quantity Management Policy (NOW)
	NSW Aquifer Interference Policy 2012 (NOW)
	Office of Water Guidelines for Controlled Activities (2012)
	Groundwater Monitoring and Modelling Plans – Information for prospective mining and petroleum exploration activities (NOW)
	Australian Groundwater Modelling Guidelines 2012 (Commonwealth)
	National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC)
	Guidelines for the Assessment & Management of Groundwater Contamination (EPA)
Surface Water	NSW Government Water Quality and River Flow Objectives (EPA)
	Using the ANZECC Guideline and Water Quality Objectives in NSW (EPA)
	National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Australian Guidelines for Water Quality Monitoring and Reporting (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Guidelines for Sewerage Systems – Effluent Management (ARMCANZ/ANZECC)
	NSW Water Conservation Strategy (2000)
	State Water Management Outcomes Plan
	NSW State Rivers and Estuary Policy (1993)
	Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (EPA)
	Managing Urban Stormwater: Soils & Construction (Landcom) and associated Volume 2E: Mines and Quarries (EPA)
	Managing Urban Stormwater: Treatment Techniques (EPA)
	Managing Urban Stormwater: Source Control (EPA)
	Technical Guidelines: Bunding & Spill Management (EPA)
	Environmental Guidelines: Use of Effluent by Irrigation (EPA)
	A Rehabilitation Manual for Australian Streams (LWRRDC and CRCCH)
	NSW Guidelines for Controlled Activities on Waterfront Land (NOW)

Land	
	Soil and Landscape Issues in Environmental Impact Assessment (NOW)
	Agfact AC.25: Agricultural Land Classification (NSW Agriculture)
	Agricultural Issues for Extractive Industries (NSW Trade and Investment)
	State Environmental Planning Policy No. 55 – Remediation of Land
	Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC)
Traffic	
	Guide to Traffic Generating Development (RMS)
	Road Design Guide (RMS) & relevant Austroads Standards
Biodiversity	
	Biodiversity Offsets Scheme (OEH)
	Guidelines for Threatened Species Assessment (DP&E)
	NSW State Groundwater Dependent Ecosystem Policy (NOW)
	Risk Assessment Guidelines for Groundwater Dependent Ecosystems (NOW)
	State Environmental Planning Policy No. 44 – Koala Habitat Protection
Heritage	
	The Burra Charter (The Australia ICOMOS charter for places of cultural significance)
	Draft Guidelines for Aboriginal Cultural Heritage Assessment and Community Consultation (DP&E)
	Aboriginal Cultural Heritage Consultation Requirements for Proponents (OEH)
	Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (OEH)
	Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH)
	NSW Heritage Manual (OEH)
	Statements of Heritage Impact (OEH)
	Port Macquarie-Hastings Local Environmental Plan 2011
Hazards	
	State Environmental Planning Policy No. 33 – Hazardous and Offensive Development
	Hazardous and Offensive Development Application Guidelines – Applying SEPP 33
	Hazardous Industry Planning Advisory Paper No. 6 – Guidelines for Hazard Analysis
Waste	
	Waste Classification Guidelines (EPA)
Rehabilitation	
	Mine Rehabilitation – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth)
	Mine Closure and Completion – Leading Practice Sustainable Development Program for the Mining Industry (Commonwealth)
	Strategic Framework for Mine Closure (ANZMEC-MCA)
Social & Economic	
	Social impact assessment guideline for State significant mining, petroleum production and extractive industry development (DP&E)
Environmental Planning Instruments - General	
	State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007
	State Environmental Planning Policy (State and Regional Development) 2011
	State Environmental Planning Policy (Infrastructure) 2007
	State Environmental Planning Policy 55 – Remediation of Land
	Port Macquarie-Hastings Local Environmental Plan 2011

ATTACHMENT 2

Agency Correspondence

NSW GOVERNMENT | Department of Primary Industries

OUT17/34142

Ms Genevieve Seed
Resource Assessments
NSW Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

genevieve.seed@planning.nsw.gov.au

Dear Ms Seed

Sancrox Quarry Extension (SSD 7293)
Request to re-issue SEARS

I refer to your email of 17 August 2017 to the Department of Primary Industries (DPI) in respect to the above matter. Comment has been sought from relevant branches of DPI.

Any further referrals to DPI can be sent by email to landuse.enquiries@dpi.nsw.gov.au.

DPI provides the following recommendations for matters to be addressed in the Environmental Impact Statement (EIS) for the proposal with additional comments at **Attachment A**.

Water

- Annual volumes of surface water and groundwater proposed to be taken by the activity (including through inflow and seepage) from each surface and groundwater source as defined by the relevant water sharing plan.
- Assessment of any volumetric water licensing requirements (including those for ongoing water take following completion of the project).
- The identification of an adequate and secure water supply for the life of the project. Confirmation that water can be sourced from an appropriately authorised and reliable supply. This is to include an assessment of the current market depth where water entitlement is required to be purchased.
- A detailed and consolidated site water balance.
- Assessment of impacts on surface and groundwater sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.
- A detailed assessment against the NSW Aquifer Interference Policy (2012) using DPI Water's assessment framework.
- Full technical details and data of all surface and groundwater modelling, and an independent peer review.
- Proposed management and disposal of produced or incidental water.

- Works are to be in accordance with the "*Guidelines for Controlled Activities on Waterfront Land* (DPI Water 2012)". It is noted a number of first and second order watercourses are mapped within the proposed extension area.
- Details of the final landform of the site, including final void management (where relevant) and rehabilitation measures.
- Proposed surface and groundwater monitoring activities and methodologies.
- Assessment of any potential cumulative impacts on water resources, and any proposed options to manage the cumulative impacts.
- Consideration of relevant policies and guidelines.
- A statement of where each element of the SEARs is addressed in the EIS in the form of a table.

Land

Department of Industry – Lands & Forestry advises that in relation to the Crown road which traverses Lot 2 DP 574308, this proposal cannot be supported or approved whilst this land remains Crown road. To proceed, the adjoining land owner must make application to the Department for road closure and purchase. For further information and the relevant forms, please go to http://www.crownland.nsw.gov.au/crown_lands/roads.

The Crown road closure and purchase process can take a significant amount of time to complete and Lands & Forestry recommends early lodgement of the application. The applicant may request expedition of the application and should provide documentation to support any such request. This request will be assessed but priority cannot be guaranteed.

Yours sincerely

Mitchell Isaacs

Director, Planning Policy & Assessment Advice

1 September 2017

DPI appreciates your help to improve our advice to you. Please complete this three minute survey about the advice we have provided to you, here:

https://goo.gl/o8TXWz

ATTACHMENT A

Sancrox Quarry Extension (SSD 7293)
DPI Water General Assessment Requirements for State Significant Development and State Significant Infrastructure projects

The following detailed assessment requirements are provided to assist in adequately addressing the assessment requirements for State Significant Development (SSD) and State Significant Infrastructure (SSI) projects for Generic projects; Coal Mines and Gas projects; Quarries and Non Coal Mines and Linear projects respectively where relevant.

For further information visit the DPI Water website, www.water.nsw.gov.au

Key Relevant Legislative Instruments

This section provides a basic summary to aid proponents in the development of an Environmental Impact Statement (EIS), and should not be considered a complete list or comprehensive summary of relevant legislative instruments that may apply to the regulation of water resources for a project.

The EIS should take into account the objects and regulatory requirements of the *Water Act 1912* (WA 1912) and *Water Management Act 2000* (*WM Act*), and associated regulations and instruments, as applicable.

Water Management Act 2000 (WM Act)
Key points:

- Volumetric licensing in areas covered by water sharing plans
- Works within 40m of waterfront land
- SSD & SSI projects are exempt from requiring water supply work approvals and controlled activity approvals as a result of the *Environmental Planning & Assessment Act 1979 (EP&A Act)*.
- No exemptions for volumetric licensing apply as a result of the *EP&A Act*.
- Harvestable rights dams
- Aquifer interference activity approval provisions have not yet commenced and are regulated by the *Water Act 1912*
- Flood management work approval provisions have now commenced
- Maximum penalties of $ 2.2 million plus $ 264,000 for each day an offence continues apply under the *WM Act*

Water Act 1912 (WA 1912)
Key points:

- Monitoring bores
- Aquifer interference activities that are not regulated as a water supply work under the *WM Act*.
- No exemptions apply to licences or permits under the *WA 1912* as a result of the *EP&A Act*.
- Regulation of water bore driller licensing.

Water Management (General) Regulation 2011
Key points:

- Provides various exemptions for volumetric licensing and activity approvals
- Provides further detail on requirements for dealings and applications.

Access Licence Dealing Principles Order 2004

Harvestable Rights Orders

Water Sharing Plans these are considered regulations under the *WM Act*

It is important that the proponent understands and describes the ground and surface water sharing plans, water sources, and management zones that apply to the project. The relevant water sharing plans can be determined spatially at www.ourwater.nsw.gov.au. Multiple water sharing plans may apply and these must all be described.

The *Water Act 1912* applies to all water sources not yet covered by a commenced water sharing plan.

The EIS is required to:

- Demonstrate how the proposal is consistent with the relevant rules of the Water Sharing Plan including rules for access licences, distance restrictions for water supply works and rules for the management of local impacts in respect of surface water and groundwater sources, ecosystem protection (including groundwater dependent ecosystems), water quality and surface-groundwater connectivity.
- Provide a description of any site water use (amount of water to be taken from each water source) and management including all sediment dams, clear water diversion structures with detail on the location, design specifications and storage capacities for all the existing and proposed water management structures.
- Provide an analysis of the proposed water supply arrangements against the rules for access licences and other applicable requirements of any relevant WSP, including:
    - Sufficient market depth to acquire the necessary entitlements for each water source.
    - Ability to carry out a “dealing” to transfer the water to relevant location under the rules of the WSP.
    - Daily and long-term access rules.
    - Account management and carryover provisions.
- Provide a detailed and consolidated site water balance.
- Further detail on licensing requirements is provided below.

Relevant Policies and Guidelines

The EIS should take into account the following policies (as applicable):

- NSW Guidelines for Controlled Activities on Waterfront Land (NOW, 2012)
- NSW Aquifer Interference Policy (NOW, 2012)
- Risk Assessment Guidelines for Groundwater Dependent Ecosystems (NOW, 2012)
- Australian Groundwater Modelling Guidelines (NWC, 2012)
- NSW State Rivers and Estuary Policy (1993)
- NSW Wetlands Policy (2010)
- NSW State Groundwater Policy Framework Document (1997)
- NSW State Groundwater Quality Protection Policy (1998)
- NSW State Groundwater Dependent Ecosystems Policy (2002)
- NSW Water Extraction Monitoring Policy (2007)

DPI Water policies can be accessed at the following links:
http://www.water.nsw.gov.au/Water-management/Law-and-policy/Key-policies/default.aspx
http://www.water.nsw.gov.au/Water-licensing/Approvals/Controlled-activities/default.aspx

An assessment framework for the NSW Aquifer Interference Policy can be found online at: http://www.water.nsw.gov.au/Water-management/Law-and-policy/Key-policies/Aquifer-interference.

Licensing Considerations

The EIS is required to provide:

- Identification of water requirements for the life of the project in terms of both volume and timing (including predictions of potential ongoing groundwater take following the cessation of operations at the site – such as evaporative loss from open voids or inflows).
- Details of the water supply source(s) for the proposal including any proposed surface water and groundwater extraction from each water source as defined in the relevant Water Sharing Plan/s and all water supply works to take water.
- Explanation of how the required water entitlements will be obtained (i.e. through a new or existing licence/s, trading on the water market, controlled allocations etc.).
- Information on the purpose, location, construction and expected annual extraction volumes including details on all existing and proposed water supply works which take surface water, (pumps, dams, diversions, etc).
- Details on all bores and excavations for the purpose of investigation, extraction, dewatering, testing and monitoring. All predicted groundwater take must be accounted for through adequate licensing.
- Details on existing dams/storages (including the date of construction, location, purpose, size and capacity) and any proposal to change the purpose of existing dams/storages
- Details on the location, purpose, size and capacity of any new proposed dams/storages.
- Applicability of any exemptions under the *Water Management (General) Regulation 2011* to the project.

Water allocation account management rules, total daily extraction limits and rules governing environmental protection and access licence dealings also need to be considered.

The Harvestable Right gives landholders the right to capture and use for any purpose 10% of the average annual runoff from their property if in the Eastern and Central Divisions. The Harvestable Right has been defined in terms of an equivalent dam capacity called the Maximum Harvestable Right Dam Capacity (MHRDC). The MHRDC is determined by the area of the property (in hectares) and a site-specific run-off factor. The MHRDC includes the capacity of all existing dams on the property that do not have a current water licence. Storages capturing up to the harvestable right capacity are not required to be licensed but any capacity of the total of all storages/dams on the property greater than the MHRDC may require a licence.

For more information on Harvestable Right dams, including a calculator, visit:
http://www.water.nsw.gov.au/Water-licensing/Basic-water-rights/Harvesting-runoff/Harvesting-runoff

Dam Safety

Where new or modified dams are proposed, or where new development will occur below an existing dam, the NSW Dams Safety Committee should be consulted in relation to any safety issues that may arise. Conditions of approval may be recommended to ensure safety in relation to any new or existing dams.

See www.damsafety.nsw.gov.au for further information.

Surface Water Assessment

The predictive assessment of the impact of the proposed project on surface water sources should include the following:

- Identification of all surface water features including watercourses, wetlands and floodplains transected by or adjacent to the proposed project.
- Identification of all surface water sources as described by the relevant water sharing plan.
- Detailed description of dependent ecosystems and existing surface water users within the area, including basic landholder rights to water and adjacent/downstream licensed water users.
- Description of all works and surface infrastructure that will intercept, store, convey, or otherwise interact with surface water resources.
- Assessment of predicted impacts on the following:
    - flow of surface water, sediment movement, channel stability, and hydraulic regime,
    - water quality,
    - flood regime,
    - dependent ecosystems,
    - existing surface water users, and
    - planned environmental water and water sharing arrangements prescribed in the relevant water sharing plans.

Groundwater Assessment

To ensure the sustainable and integrated management of groundwater sources, the EIS needs to include adequate details to assess the impact of the project on all groundwater sources.

Where it is considered unlikely that groundwater will be intercepted or impacted (for example by infiltration), a brief site assessment and justification for the minimal impacts may be sufficient, accompanied by suitable contingency measures in place in the event that groundwater is intercepted, and appropriate measures to ensure that groundwater is not contaminated.

Where groundwater is expected to be intercepted or impacted, the following requirements should be used to assist the groundwater assessment for the proposal.

- The known or predicted highest groundwater table at the site.
- Works likely to intercept, connect with or infiltrate the groundwater sources.
- Any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes.
- Bore construction information is to be supplied to DPI Water by submitting a “Form A” template. DPI Water will supply “GW” registration numbers (and licence/approval numbers if required) which must be used as consistent and unique bore identifiers for all future reporting.

- A description of the watertable and groundwater pressure configuration, flow directions and rates and physical and chemical characteristics of the groundwater source (including connectivity with other groundwater and surface water sources).
- Sufficient baseline monitoring for groundwater quantity and quality for all aquifers and GDEs to establish a baseline incorporating typical temporal and spatial variations.
- The predicted impacts of any final landform on the groundwater regime.
- The existing groundwater users within the area (including the environment), any potential impacts on these users and safeguard measures to mitigate impacts.
- An assessment of groundwater quality, its beneficial use classification and prediction of any impacts on groundwater quality.
- An assessment of the potential for groundwater contamination (considering both the impacts of the proposal on groundwater contamination and the impacts of contamination on the proposal).
- Measures proposed to protect groundwater quality, both in the short and long term.
- Measures for preventing groundwater pollution so that remediation is not required.
- Protective measures for any groundwater dependent ecosystems (GDEs).
- Proposed methods of the disposal of waste water and approval from the relevant authority.
- The results of any models or predictive tools used.

Where potential impact/s are identified the assessment will need to identify limits to the level of impact and contingency measures that would remediate, reduce or manage potential impacts to the existing groundwater resource and any dependent groundwater environment or water users, including information on:

- Any proposed monitoring programs, including water levels and quality data.
- Reporting procedures for any monitoring program including mechanism for transfer of information.
- An assessment of any groundwater source/aquifer that may be sterilised from future use as a water supply as a consequence of the proposal.
- Identification of any nominal thresholds as to the level of impact beyond which remedial measures or contingency plans would be initiated (this may entail water level triggers or a beneficial use category).
- Description of the remedial measures or contingency plans proposed.
- Any funding assurances covering the anticipated post development maintenance cost, for example on-going groundwater monitoring for the nominated period.

Groundwater Dependent Ecosystems

The EIS must consider the potential impacts on any Groundwater Dependent Ecosystems (GDEs) at the site and in the vicinity of the site and:

- Identify any potential impacts on GDEs as a result of the proposal including:
    - the effect of the proposal on the recharge to groundwater systems;
    - the potential to adversely affect the water quality of the underlying groundwater system and adjoining groundwater systems in hydraulic connections; and
    - the effect on the function of GDEs (habitat, groundwater levels, connectivity).

- Provide safeguard measures for any GDEs.

Watercourses, Wetlands and Riparian Land

The EIS should address the potential impacts of the project on all watercourses likely to be affected by the project, existing riparian vegetation and the rehabilitation of riparian land. It is recommended the EIS provides details on all watercourses potentially affected by the proposal, including:

- Scaled plans showing the location of:
  - wetlands/swamps, watercourses and top of bank;
  - riparian corridor widths to be established along the creeks;
  - existing riparian vegetation surrounding the watercourses (identify any areas to be protected and any riparian vegetation proposed to be removed);
  - the site boundary, the footprint of the proposal in relation to the watercourses and riparian areas; and
  - proposed location of any asset protection zones.
- Photographs of the watercourses/wetlands and a map showing the point from which the photos were taken.
- A detailed description of all potential impacts on the watercourses/riparian land.
- A detailed description of all potential impacts on the wetlands, including potential impacts to the wetlands hydrologic regime; groundwater recharge; habitat and any species that depend on the wetlands.
- A description of the design features and measures to be incorporated to mitigate potential impacts.
- Geomorphic and hydrological assessment of water courses including details of stream order (Strahler System), river style and energy regimes both in channel and on adjacent floodplains.

Drill Pad, Well and Access Road Construction (applies to Coal Mines and Gas projects and Quarries and Non Coal Mine projects)

- Any construction activity within 40m of a watercourse, should be designed by a suitably qualified person, consistent with the NSW *Guidelines for Controlled Activities on Waterfront Land* (July 2012).
- Construction of all wells must be undertaken in accordance with the *Minimum Construction Requirements for Water Bores in Australia* (3rd edition 2012) by a driller holding a bore drillers' licence valid in New South Wales.
- The length of time that a core hole is maintained as an open hole should be minimised.

Landform rehabilitation

Where significant modification to landform is proposed, the EIS must include:

- Justification of the proposed final landform with regard to its impact on local and regional surface and groundwater systems;
- A detailed description of how the site would be progressively rehabilitated and integrated into the surrounding landscape;
- Outline of proposed construction and restoration of topography and surface drainage features if affected by the project; and

- An outline of the measures to be put in place to ensure that sufficient resources are available to implement the proposed rehabilitation.

Additional Landform Rehabilitation Requirements for Coal mines and Gas projects and Quarries and Non Coal Mines (including final void management)

- Detailed modelling of potential groundwater volume, flow and quality impacts of the presence of an inundated final void (where relevant) on identified receptors specifically considering those environmental systems that are likely to be groundwater dependent;
- The measures that would be established for the long-term protection of local and regional aquifer systems and for the ongoing management of the site following the cessation of the project.

Consultation and general enquiries

Assessment of state significant development enquiries, or requests for review or consultation should be directed to the, Water Regulation Co-ordination Unit, water.referrals@dpi.nsw.gov.au.

A consultation guideline and further information is available online at:
www.water.nsw.gov.au/water-management/law-and-policy/planning-and-assessment

End Attachment A

NSW GOVERNMENT | Department of Primary Industries

OUT17/34142

Ms Genevieve Seed
Resource Assessments
NSW Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

genevieve.seed@planning.nsw.gov.au

Dear Ms Seed

Sancrox Quarry Extension (SSD 7293)
Request to re-issue SEARS

I refer to your email of 17 August 2017 to the Department of Primary Industries (DPI) in respect to the above matter. Comment has been sought from relevant branches of DPI.

Any further referrals to DPI can be sent by email to landuse.enquiries@dpi.nsw.gov.au.

DPI provides the following recommendations for matters to be addressed in the Environmental Impact Statement (EIS) for the proposal with additional comments at **Attachment A**.

Water

- Annual volumes of surface water and groundwater proposed to be taken by the activity (including through inflow and seepage) from each surface and groundwater source as defined by the relevant water sharing plan.
- Assessment of any volumetric water licensing requirements (including those for ongoing water take following completion of the project).
- The identification of an adequate and secure water supply for the life of the project. Confirmation that water can be sourced from an appropriately authorised and reliable supply. This is to include an assessment of the current market depth where water entitlement is required to be purchased.
- A detailed and consolidated site water balance.
- Assessment of impacts on surface and groundwater sources (both quality and quantity), related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, and groundwater dependent ecosystems, and measures proposed to reduce and mitigate these impacts.
- A detailed assessment against the NSW Aquifer Interference Policy (2012) using DPI Water's assessment framework.
- Full technical details and data of all surface and groundwater modelling, and an independent peer review.
- Proposed management and disposal of produced or incidental water.

- Works are to be in accordance with the "*Guidelines for Controlled Activities on Waterfront Land* (DPI Water 2012)". It is noted a number of first and second order watercourses are mapped within the proposed extension area.
- Details of the final landform of the site, including final void management (where relevant) and rehabilitation measures.
- Proposed surface and groundwater monitoring activities and methodologies.
- Assessment of any potential cumulative impacts on water resources, and any proposed options to manage the cumulative impacts.
- Consideration of relevant policies and guidelines.
- A statement of where each element of the SEARs is addressed in the EIS in the form of a table.

Land

Department of Industry – Lands & Forestry advises that in relation to the Crown road which traverses Lot 2 DP 574308, this proposal cannot be supported or approved whilst this land remains Crown road. To proceed, the adjoining land owner must make application to the Department for road closure and purchase. For further information and the relevant forms, please go to http://www.crownland.nsw.gov.au/crown_lands/roads.

The Crown road closure and purchase process can take a significant amount of time to complete and Lands & Forestry recommends early lodgement of the application. The applicant may request expedition of the application and should provide documentation to support any such request. This request will be assessed but priority cannot be guaranteed.

Yours sincerely

Mitchell Isaacs

Director, Planning Policy & Assessment Advice

1 September 2017

DPI appreciates your help to improve our advice to you. Please complete this three minute survey about the advice we have provided to you, here:

https://goo.gl/o8TXWz

ATTACHMENT A

Sancrox Quarry Extension (SSD 7293)
DPI Water General Assessment Requirements for State Significant Development and State Significant Infrastructure projects

The following detailed assessment requirements are provided to assist in adequately addressing the assessment requirements for State Significant Development (SSD) and State Significant Infrastructure (SSI) projects for Generic projects; Coal Mines and Gas projects; Quarries and Non Coal Mines and Linear projects respectively where relevant.

For further information visit the DPI Water website, www.water.nsw.gov.au

Key Relevant Legislative Instruments

This section provides a basic summary to aid proponents in the development of an Environmental Impact Statement (EIS), and should not be considered a complete list or comprehensive summary of relevant legislative instruments that may apply to the regulation of water resources for a project.

The EIS should take into account the objects and regulatory requirements of the *Water Act 1912* (WA 1912) and *Water Management Act 2000* (*WM Act*), and associated regulations and instruments, as applicable.

Water Management Act 2000 (WM Act)
Key points:

- Volumetric licensing in areas covered by water sharing plans
- Works within 40m of waterfront land
- SSD & SSI projects are exempt from requiring water supply work approvals and controlled activity approvals as a result of the *Environmental Planning & Assessment Act 1979 (EP&A Act)*.
- No exemptions for volumetric licensing apply as a result of the *EP&A Act*.
- Harvestable rights dams
- Aquifer interference activity approval provisions have not yet commenced and are regulated by the *Water Act 1912*
- Flood management work approval provisions have now commenced
- Maximum penalties of $ 2.2 million plus $ 264,000 for each day an offence continues apply under the *WM Act*

Water Act 1912 (WA 1912)
Key points:

- Monitoring bores
- Aquifer interference activities that are not regulated as a water supply work under the *WM Act*.
- No exemptions apply to licences or permits under the *WA 1912* as a result of the *EP&A Act*.
- Regulation of water bore driller licensing.

Water Management (General) Regulation 2011
Key points:

- Provides various exemptions for volumetric licensing and activity approvals
- Provides further detail on requirements for dealings and applications.

Access Licence Dealing Principles Order 2004

Harvestable Rights Orders

Water Sharing Plans these are considered regulations under the *WM Act*

It is important that the proponent understands and describes the ground and surface water sharing plans, water sources, and management zones that apply to the project. The relevant water sharing plans can be determined spatially at www.ourwater.nsw.gov.au. Multiple water sharing plans may apply and these must all be described.

The *Water Act 1912* applies to all water sources not yet covered by a commenced water sharing plan.

The EIS is required to:

- Demonstrate how the proposal is consistent with the relevant rules of the Water Sharing Plan including rules for access licences, distance restrictions for water supply works and rules for the management of local impacts in respect of surface water and groundwater sources, ecosystem protection (including groundwater dependent ecosystems), water quality and surface-groundwater connectivity.
- Provide a description of any site water use (amount of water to be taken from each water source) and management including all sediment dams, clear water diversion structures with detail on the location, design specifications and storage capacities for all the existing and proposed water management structures.
- Provide an analysis of the proposed water supply arrangements against the rules for access licences and other applicable requirements of any relevant WSP, including:
    - Sufficient market depth to acquire the necessary entitlements for each water source.
    - Ability to carry out a “dealing” to transfer the water to relevant location under the rules of the WSP.
    - Daily and long-term access rules.
    - Account management and carryover provisions.
- Provide a detailed and consolidated site water balance.
- Further detail on licensing requirements is provided below.

Relevant Policies and Guidelines

The EIS should take into account the following policies (as applicable):

- NSW Guidelines for Controlled Activities on Waterfront Land (NOW, 2012)
- NSW Aquifer Interference Policy (NOW, 2012)
- Risk Assessment Guidelines for Groundwater Dependent Ecosystems (NOW, 2012)
- Australian Groundwater Modelling Guidelines (NWC, 2012)
- NSW State Rivers and Estuary Policy (1993)
- NSW Wetlands Policy (2010)
- NSW State Groundwater Policy Framework Document (1997)
- NSW State Groundwater Quality Protection Policy (1998)
- NSW State Groundwater Dependent Ecosystems Policy (2002)
- NSW Water Extraction Monitoring Policy (2007)

DPI Water policies can be accessed at the following links:
http://www.water.nsw.gov.au/Water-management/Law-and-policy/Key-policies/default.aspx
http://www.water.nsw.gov.au/Water-licensing/Approvals/Controlled-activities/default.aspx

An assessment framework for the NSW Aquifer Interference Policy can be found online at: http://www.water.nsw.gov.au/Water-management/Law-and-policy/Key-policies/Aquifer-interference.

Licensing Considerations

The EIS is required to provide:

- Identification of water requirements for the life of the project in terms of both volume and timing (including predictions of potential ongoing groundwater take following the cessation of operations at the site – such as evaporative loss from open voids or inflows).
- Details of the water supply source(s) for the proposal including any proposed surface water and groundwater extraction from each water source as defined in the relevant Water Sharing Plan/s and all water supply works to take water.
- Explanation of how the required water entitlements will be obtained (i.e. through a new or existing licence/s, trading on the water market, controlled allocations etc.).
- Information on the purpose, location, construction and expected annual extraction volumes including details on all existing and proposed water supply works which take surface water, (pumps, dams, diversions, etc).
- Details on all bores and excavations for the purpose of investigation, extraction, dewatering, testing and monitoring. All predicted groundwater take must be accounted for through adequate licensing.
- Details on existing dams/storages (including the date of construction, location, purpose, size and capacity) and any proposal to change the purpose of existing dams/storages
- Details on the location, purpose, size and capacity of any new proposed dams/storages.
- Applicability of any exemptions under the *Water Management (General) Regulation 2011* to the project.

Water allocation account management rules, total daily extraction limits and rules governing environmental protection and access licence dealings also need to be considered.

The Harvestable Right gives landholders the right to capture and use for any purpose 10% of the average annual runoff from their property if in the Eastern and Central Divisions. The Harvestable Right has been defined in terms of an equivalent dam capacity called the Maximum Harvestable Right Dam Capacity (MHRDC). The MHRDC is determined by the area of the property (in hectares) and a site-specific run-off factor. The MHRDC includes the capacity of all existing dams on the property that do not have a current water licence. Storages capturing up to the harvestable right capacity are not required to be licensed but any capacity of the total of all storages/dams on the property greater than the MHRDC may require a licence.

For more information on Harvestable Right dams, including a calculator, visit:
http://www.water.nsw.gov.au/Water-licensing/Basic-water-rights/Harvesting-runoff/Harvesting-runoff

Dam Safety

Where new or modified dams are proposed, or where new development will occur below an existing dam, the NSW Dams Safety Committee should be consulted in relation to any safety issues that may arise. Conditions of approval may be recommended to ensure safety in relation to any new or existing dams.

See www.damsafety.nsw.gov.au for further information.

Surface Water Assessment

The predictive assessment of the impact of the proposed project on surface water sources should include the following:

- Identification of all surface water features including watercourses, wetlands and floodplains transected by or adjacent to the proposed project.
- Identification of all surface water sources as described by the relevant water sharing plan.
- Detailed description of dependent ecosystems and existing surface water users within the area, including basic landholder rights to water and adjacent/downstream licensed water users.
- Description of all works and surface infrastructure that will intercept, store, convey, or otherwise interact with surface water resources.
- Assessment of predicted impacts on the following:
    - flow of surface water, sediment movement, channel stability, and hydraulic regime,
    - water quality,
    - flood regime,
    - dependent ecosystems,
    - existing surface water users, and
    - planned environmental water and water sharing arrangements prescribed in the relevant water sharing plans.

Groundwater Assessment

To ensure the sustainable and integrated management of groundwater sources, the EIS needs to include adequate details to assess the impact of the project on all groundwater sources.

Where it is considered unlikely that groundwater will be intercepted or impacted (for example by infiltration), a brief site assessment and justification for the minimal impacts may be sufficient, accompanied by suitable contingency measures in place in the event that groundwater is intercepted, and appropriate measures to ensure that groundwater is not contaminated.

Where groundwater is expected to be intercepted or impacted, the following requirements should be used to assist the groundwater assessment for the proposal.

- The known or predicted highest groundwater table at the site.
- Works likely to intercept, connect with or infiltrate the groundwater sources.
- Any proposed groundwater extraction, including purpose, location and construction details of all proposed bores and expected annual extraction volumes.
- Bore construction information is to be supplied to DPI Water by submitting a “Form A” template. DPI Water will supply “GW” registration numbers (and licence/approval numbers if required) which must be used as consistent and unique bore identifiers for all future reporting.

- A description of the watertable and groundwater pressure configuration, flow directions and rates and physical and chemical characteristics of the groundwater source (including connectivity with other groundwater and surface water sources).
- Sufficient baseline monitoring for groundwater quantity and quality for all aquifers and GDEs to establish a baseline incorporating typical temporal and spatial variations.
- The predicted impacts of any final landform on the groundwater regime.
- The existing groundwater users within the area (including the environment), any potential impacts on these users and safeguard measures to mitigate impacts.
- An assessment of groundwater quality, its beneficial use classification and prediction of any impacts on groundwater quality.
- An assessment of the potential for groundwater contamination (considering both the impacts of the proposal on groundwater contamination and the impacts of contamination on the proposal).
- Measures proposed to protect groundwater quality, both in the short and long term.
- Measures for preventing groundwater pollution so that remediation is not required.
- Protective measures for any groundwater dependent ecosystems (GDEs).
- Proposed methods of the disposal of waste water and approval from the relevant authority.
- The results of any models or predictive tools used.

Where potential impact/s are identified the assessment will need to identify limits to the level of impact and contingency measures that would remediate, reduce or manage potential impacts to the existing groundwater resource and any dependent groundwater environment or water users, including information on:

- Any proposed monitoring programs, including water levels and quality data.
- Reporting procedures for any monitoring program including mechanism for transfer of information.
- An assessment of any groundwater source/aquifer that may be sterilised from future use as a water supply as a consequence of the proposal.
- Identification of any nominal thresholds as to the level of impact beyond which remedial measures or contingency plans would be initiated (this may entail water level triggers or a beneficial use category).
- Description of the remedial measures or contingency plans proposed.
- Any funding assurances covering the anticipated post development maintenance cost, for example on-going groundwater monitoring for the nominated period.

Groundwater Dependent Ecosystems

The EIS must consider the potential impacts on any Groundwater Dependent Ecosystems (GDEs) at the site and in the vicinity of the site and:

- Identify any potential impacts on GDEs as a result of the proposal including:
    - the effect of the proposal on the recharge to groundwater systems;
    - the potential to adversely affect the water quality of the underlying groundwater system and adjoining groundwater systems in hydraulic connections; and
    - the effect on the function of GDEs (habitat, groundwater levels, connectivity).

- Provide safeguard measures for any GDEs.

Watercourses, Wetlands and Riparian Land

The EIS should address the potential impacts of the project on all watercourses likely to be affected by the project, existing riparian vegetation and the rehabilitation of riparian land. It is recommended the EIS provides details on all watercourses potentially affected by the proposal, including:

- Scaled plans showing the location of:
  - wetlands/swamps, watercourses and top of bank;
  - riparian corridor widths to be established along the creeks;
  - existing riparian vegetation surrounding the watercourses (identify any areas to be protected and any riparian vegetation proposed to be removed);
  - the site boundary, the footprint of the proposal in relation to the watercourses and riparian areas; and
  - proposed location of any asset protection zones.
- Photographs of the watercourses/wetlands and a map showing the point from which the photos were taken.
- A detailed description of all potential impacts on the watercourses/riparian land.
- A detailed description of all potential impacts on the wetlands, including potential impacts to the wetlands hydrologic regime; groundwater recharge; habitat and any species that depend on the wetlands.
- A description of the design features and measures to be incorporated to mitigate potential impacts.
- Geomorphic and hydrological assessment of water courses including details of stream order (Strahler System), river style and energy regimes both in channel and on adjacent floodplains.

Drill Pad, Well and Access Road Construction (applies to Coal Mines and Gas projects and Quarries and Non Coal Mine projects)

- Any construction activity within 40m of a watercourse, should be designed by a suitably qualified person, consistent with the NSW *Guidelines for Controlled Activities on Waterfront Land* (July 2012).
- Construction of all wells must be undertaken in accordance with the *Minimum Construction Requirements for Water Bores in Australia* (3rd edition 2012) by a driller holding a bore drillers' licence valid in New South Wales.
- The length of time that a core hole is maintained as an open hole should be minimised.

Landform rehabilitation

Where significant modification to landform is proposed, the EIS must include:

- Justification of the proposed final landform with regard to its impact on local and regional surface and groundwater systems;
- A detailed description of how the site would be progressively rehabilitated and integrated into the surrounding landscape;
- Outline of proposed construction and restoration of topography and surface drainage features if affected by the project; and

- An outline of the measures to be put in place to ensure that sufficient resources are available to implement the proposed rehabilitation.

Additional Landform Rehabilitation Requirements for Coal mines and Gas projects and Quarries and Non Coal Mines (including final void management)

- Detailed modelling of potential groundwater volume, flow and quality impacts of the presence of an inundated final void (where relevant) on identified receptors specifically considering those environmental systems that are likely to be groundwater dependent;
- The measures that would be established for the long-term protection of local and regional aquifer systems and for the ongoing management of the site following the cessation of the project.

Consultation and general enquiries

Assessment of state significant development enquiries, or requests for review or consultation should be directed to the, Water Regulation Co-ordination Unit, water.referrals@dpi.nsw.gov.au.

A consultation guideline and further information is available online at:
www.water.nsw.gov.au/water-management/law-and-policy/planning-and-assessment

End Attachment A

DOC17/427522-01; EF13/3037 (SSD 7293)

Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Genevieve Seed

By email: genevieve.seed@planning.nsw.gov.au

Dear Ms Seed

Sancrox Quarry Extension (SSD 7293)
Reissue of Secretary's Environmental Assessment Requirements

I refer to your email to the Environment Protection Authority (EPA), dated 17 August 2017, seeking the EPA's recommended Secretary Environmental Assessment Requirements (SEARS) for the Sancrox Quarry extension proposal, SSD 7293. Provided with your email is the report titled '*Sancrox Quarry Expansion Project – Preliminary Environmental Impact Statement*', dated August 2015.

The EPA notes the request is for the reissuing of the SEARS, as previous SEARS were provided in relation to this proposal in October 2015. As the proposal, has not been altered from the previous 2015 application, the EPA has reviewed the 2015 SEARS submitted and updated them accordingly. These updates primarily relate to the guideline references.

The updated SEARS have been provided at **Attachment A** and the updated guidance material list at **Attachment B**.

The EPA's key information requirements for the project are summarised below and include an adequate description and assessment of:

1. Project proposal including size of the operation, proposed processes, operational hours, maximum and average annual production rate, staging and timing of the proposal;
2. Air quality impacts including a description of all emissions and a specific description of proposed air pollution management strategies;
3. Noise and vibration impacts associated with the proposed construction and hours of operation.
4. Water management onsite including process and stormwater management, sedimentation ponds, details and justification for any proposed discharge(s) and the sensitivity of the receiving environment.
5. Waste generation, source location, classification, quantities, reuse and management measures for activities undertaken at the premises;
6. A proposed monitoring plan to assess the impact on the environment and surrounding receivers over time;
7. An assessment of the cumulative impacts associated with this proposal and other activities in the local area; and

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8. Actions that will be taken to avoid or mitigate impacts or compensate for any unavoidable impacts associated with proposed operations.

In carrying out the assessment, the proponent should refer to the relevant guidelines listed in **Attachment B** and any relevant industry codes of practice and best practice management guidelines.

The proponent should also be aware that any commitments made in the EIS may be formalised as approval conditions and subsequently environment protection licence conditions. Pollution control measures should not be proposed if they are impractical, unrealistic or beyond the financial viability of the development. It is important that all conclusions are supported by adequate data.

If you require any further information regarding this matter, please contact me on 4908 6819 or by email to hunter.region@epa.nsw.gov.au.

Yours sincerely

30/8/17

MICHAEL HOWAT
A/Head Strategic Programs Unit - Hunter
Environment Protection Authority

Encl: **Attachment A** – EPA's Recommended Secretary's Environmental Assessment Requirements – Sancrox Quarry Extension Project (SSD 7293)

Attachment B – Guidance Material

ATTACHMENT A

EPA's Recommended Secretary's Environmental Assessment Requirements – Sancrox Quarry Extension Project (SSD 7293)

1 Environmental impacts of the project

Impacts related to the following environmental issues need to be assessed, quantified and reported on:

- Air Quality
- Noise and Vibration
- Water and Soil Quality and Management
- Waste Management
- Dangerous Goods, Chemical Storage and Bunding

The Environmental Impact Statement (EIS) should address the specific requirements outlined under each heading below and assess impacts in accordance with the relevant guidelines mentioned. A full list of guidelines is at Attachment B.

2 Licensing requirements

Should project approval be granted, the proponent will need to make a separate application to EPA for any variations to the existing Environment Protection Licence No. 5289 for the quarry. Additional information is available through EPA's *Guide to Licensing* document.
http://www.epa.nsw.gov.au/resources/licensing/licensing-guide-160369.pdf

General information on licence requirements can also be obtained from EPA's Environment Line on 131 555 during office hours, or can be found at the EPA web site at:
http://www.epa.nsw.gov.au/licensing/

3 The Proposal and Premises

The objectives of the proposal should be clearly stated and refer to:

- The size and type of the operation;
- The nature of the processes and the products, by-products and wastes produced;
- The types and quantities of any chemicals to be used and stored onsite;
- Proposed operational hours, including any heavy vehicle movements;
- Proposed maximum and average annual production rates that will occur at the premises; and
- Proposed staging and timing of the proposal.

The EIS will need to fully identify all the processes and activities intended for the site over the life of the development. This will include details of:

- The location of the proposed facility and details of the surrounding environment;
- The proposed layout of the site;
- Appropriate land use zoning;
- Ownership details of any residence and/or land likely to be affected by the proposed operations;
- Maps/diagrams showing the location of residences and properties likely to be affected and other industrial developments, conservation areas, wetlands, etc. in the locality that may be affected by the facility;
- All equipment proposed for use at the site;
- All chemicals, including fuel, used on the site and proposed methods for their transportation, storage, use and emergency management;
- Clearly detail the boundary of the premises; and
- Methods to mitigate any expected environmental impacts of the development.

4 Air Issues

Given the proposed extension of the extraction boundary and addition of potentially odorous activities such as asphalt production, the EIS should include a detailed assessment of air quality and odour impacts. The following matters should be addressed as part of the EIS.

- Assess the risk associated with potential discharges of fugitive and point source emissions for all stages of the proposal. Assessment of risk relates to environmental harm, risk to human health and amenity.

- Justify the level of assessment undertaken on the basis of risk factors, including but not limited to:
    - proposal location;
    - characteristics of the receiving environment; and
    - type and quantity of pollutants emitted.

- Describe the receiving environment in detail. The proposal must be contextualised within the receiving environment (local, regional and inter-regional as appropriate). The description must include but need not be limited to:
    - meteorology and climate;
    - topography;
    - surrounding land-use; receptors; and
    - ambient air quality.

- Include a detailed description of the proposal. All processes that could result in air emissions must be identified and described. Sufficient detail to accurately communicate the characteristics and quantity of all emissions must be provided.

- Include a consideration of 'worst case' emission scenarios and impacts at proposed emission limits.

- Account for cumulative impacts associated with existing emission sources as well as any currently approved developments linked to the receiving environment.

- Include air dispersion modelling where there is a risk of adverse air quality impacts, or where there is sufficient uncertainty to warrant a rigorous numerical impact assessment. Air dispersion modelling must be conducted in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (2016).

- Demonstrate the proposal's ability to comply with the relevant regulatory framework, specifically the *Protection of the Environment Operations* (POEO) *Act* (1997) and the POEO (Clean Air) Regulation (2010).

- Provide an assessment of the project in terms of the priorities and targets adopted under the NSW State Plan 2010 and its implementation plan Action for Air.

- Detail emission control techniques/practices that will be employed by the proposal.

- Detail monitoring that will be conducted to assess the impacts of the proposal.

5 Noise and Vibration

The following matters should be addressed in relation to noise and vibration impacts associated with the proposal. This includes identification of the hours of operations, assessment of all activities where proposed, and impacts on sensitive receivers associated with the proposed hours of operation. The following matters should be addressed as part of the EIS.

General

- Construction noise associated with the proposed development should be assessed using the Interim Construction Noise Guideline (DECC, 2009).

- Vibration from all activities (including construction and operation) to be undertaken on the premises should be assessed using the guidelines contained in the Assessing Vibration: a technical guideline (DEC, 2006).

- Blast impacts should be demonstrated to be capable of complying with the guidelines contained in Australian and New Zealand Environment Council – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZEC, 1990).

Industry

- Operational noise from all industrial activities (including private haul roads) to be undertaken on the premises should be assessed using the guidelines contained in the NSW Industrial Noise Policy (EPA, 2000) and Industrial Noise Policy Application Notes.

Road

- Noise on public roads from increased road traffic generated by land use developments should be assessed using the guidelines contained in the NSW Road Noise Policy (DECCW, 2011).

- Noise from new or upgraded public roads should be assessed using the NSW Road Noise Policy (DECCW, 2011).

Monitoring

- Detail monitoring that will be conducted to assess the impacts of the proposal.

6 Water and Soils

6.1 Water Quality

Describe Proposal

- Describe the proposal including position of any intakes and discharges, volumes, water quality and frequency of all water discharges.

- Demonstrate that all practical options to avoid discharges have been implemented and environmental impact minimised where discharge is necessary.

- Where relevant include a water balance for the development including water requirements (quantity, quality and source(s)) and proposed storm and wastewater disposal, including type, volumes, proposed treatment and management methods and re-use options.

Background Conditions

- Describe existing surface and groundwater quality. An assessment needs to be undertaken for any water resource likely to be affected by the proposal. Issues to be discussed should include but are not limited to:
  - a description of any impacts from existing industry or activities on water quality
  - a description of the condition of the local catchment e.g. erosion, soils, vegetation cover, etc.
  - an outline of baseline groundwater information, including, for example, depth to water table, flow direction and gradient, groundwater quality, reliance on groundwater by surrounding users and by the environment

  - historic river flow data

- State the Water Quality Objectives for the receiving waters relevant to the proposal. These refer to the community's agreed environmental values and human uses endorsed by the NSW Government as goals for ambient waters (http://www.environment.nsw.gov.au/ieo/index.htm). Where groundwater may be impacted the assessment should identify appropriate groundwater environmental values.

- State the indicators and associated trigger values or criteria for the identified environmental values. This information should be based on the ANZECC (2000) Guidelines for Fresh and Marine Water Quality as a minimum but should also be based on advice from Hunter Water Corporation given the sensitive receiving environment of Grahamstown Dam water supply.

- State any locally specific objectives, criteria or targets which have been endorsed by the NSW Government.

Impact Assessment

- Describe the nature and degree of impact that any proposed discharges will have on the receiving environment, both surface water and groundwater.
- Detail contractual and other arrangements that will be put in place to prevent pollution from haul roads and unsealed roads per se, particularly rights of carriageways not owned by the proponent.
- Assess impacts against the relevant ambient water quality outcomes. Demonstrate how the proposal will be designed and operated to:
  - protect the Water Quality Objectives for receiving waters where they are currently being achieved; and
  - contribute towards achievement of the Water Quality Objectives over time where they are not currently being achieved.
- Where a discharge is proposed that includes a mixing zone, the proposal should demonstrate how wastewater discharged to waterways will ensure the ANZECC (2000) water quality criteria for relevant chemical and non-chemical parameters are met at the edge of the initial mixing zone of the discharge, and that any impacts in the initial mixing zone are demonstrated to be reversible.
- Propose water quality limits for any discharge(s) that adequately protects the receiving environment.
- Assess impacts on groundwater and groundwater dependent ecosystems.
- Describe how stormwater will be managed both during and after construction.

Monitoring

- Describe how predicted impacts will be monitored and assessed over time.

6.2 Soil

The EIS should include:

- An assessment of potential impacts on soil and land resources should be undertaken, being guided by Soil and Landscape Issues in Environmental Impact Assessment (DLWC 2000). The nature and extent of any significant impacts should be identified. Particular attention should be given to:
  - Soil erosion and sediment transport - in accordance with Managing urban stormwater: soils and construction, vol. 1 (Landcom 2004) and vol. 2 (A. Installation of services; B Waste landfills; C. Unsealed roads; D. Main Roads; E. Mines and quarries) (DECC 2008).

- Mass movement (landslides) – in accordance with Landslide risk management guidelines presented in Australian Geomechanics Society (2007).
- Urban and regional salinity – guidance given in the Local Government Salinity Initiative booklets which includes Site Investigations for Urban Salinity (DLWC, 2002).

- A description of the mitigation and management options that will be used to prevent, control, abate or minimise identified soil and land resource impacts associated with the project. This should include an assessment of the effectiveness and reliability of the measures and any residual impacts after these measures are implemented.

7 Waste

The EIS should:

- Include a detailed plan for in-situ classification of waste material, including the sampling locations and sampling regime that will be employed to classify the waste, particularly with regards to the identification of contamination hotspots.

- Identify, quantify, characterise and classify all waste that currently exists at the site. Identify the intended end use, for example reuse or disposal, and the end use location(s) for the waste. Also, specify the mechanism under which waste will be reused or disposed, such as a Resource Recovery Exemption. Note: All waste must be classified in accordance with EPA's Classification Guidelines.

- Identify, characterise and classify all waste that will be generated onsite through excavation, demolition or construction activities, including proposed quantities of the waste.
  Note: All waste must be classified in accordance with EPA's Waste Classification Guidelines.

- Identify, characterise and classify all waste that is proposed to be disposed of to an offsite location, including proposed quantities of the waste and the disposal locations for the waste. This includes waste that is intended for re-use or recycling.
  Note: All waste must be classified in accordance with EPA's Classification Guidelines.

- Include a commitment to retaining all sampling and classification results for the life of the project to demonstrate compliance with EPA's Waste Classification Guidelines.

- Provide details of how waste will be handled and managed onsite to minimise pollution, including:

  a) Stockpile location and management
     - Labelling of stockpiles for identification, ensuring that all waste is clearly identified and stockpiled separately from other types of material (especially the separation of any contaminated and non-contaminated waste).
     - Proposed height limits for all waste to reduce the potential for dust and odour.
     - Procedures for minimising the movement of waste around the site and double handling.
     - Measures to minimise leaching from stockpiles into the surrounding environment, such as sediment fencing, geofabric liners etc.

  b) Erosion, sediment and leachate control including measures to be implemented to minimise erosion, leachate and sediment mobilisation at the site during works. The EIS should show the location of each measure to be implemented. The Proponent should consider measures such as:
     - Sediment traps
     - Diversion banks
     - Sediment fences
     - Bunds (earth, hay, mulch)

- Geofabric liners
- Other control measures as appropriate

The Proponent should also provide details of:
- how leachate from stockpiled waste material will be kept separate from stormwater runoff;
- treatment of leachate through a wastewater treatment plant (if applicable); and
- any proposed transport and disposal of leachate off-site.

- Provide details of how the waste will be handled and managed during transport to a lawful facility. If the waste possesses hazardous characteristics, the Proponent must provide details of how the waste will be treated or immobilised to render it suitable for transport and disposal.

- Include details of all procedures and protocols to be implemented to ensure that any waste leaving the site is transported and disposed of lawfully and does not pose a risk to human health or the environment.

- Include a statement demonstrating that the Proponent is aware of EPA's requirements with respect to notification and tracking of waste.

- Include a statement demonstrating that the Proponent is aware of the relevant legislative requirements for disposal of the waste, including any relevant Resource Recovery Exemptions, as gazetted by EPA from time to time.

- Outline contingency plans for any event that affects operations at the site that may result in environmental harm, including: excessive stockpiling of waste, volume of leachate generated exceeds the storage capacity available on-site etc.

8 Dangerous Goods, Chemical storage and Bunding

- The EIS must outline all details regarding the transport, handling, storage and use of dangerous goods, chemicals and products, including fuel, both on site and with ancillary activities and describe the measures proposed to minimise the potential for leakage or the migration of pollutants into the soil/waters or from the site.

- The EIS should identify any fuel or chemical storage areas proposed for the site.

- The EIS should consider compliance with the following legislation, standards and guidelines where relevant:
  - Australian Standard AS1692:1989 Tanks for Flammable and combustible liquids;
  - The DECC's "Bunding and Spill Management" Technical Guideline (November 1997)
  - Australian Standard AS 1940:2004 The Storage and Handling of Flammable and Combustible Liquids
  - Australia Standard AS 4452-1997: The Storage and Handling of Toxic Substances;
  - Australian/New Zealand Standard AS/NZS 4452:1997: The Storage and Handling of Mixed Classes of Dangerous Goods in Packages and Intermediate Bulk Containers; and
  - Road and Rail Transport (Dangerous Goods) Act 1997

9 Monitoring Programs

The EIS should include a detailed assessment of any noise, air quality, weather, water or waste monitoring required during the construction and on-going operation of the site to ensure that the development achieves a satisfactory level of environmental performance. The evaluation should include a detailed description of the monitoring locations, sample analysis methods and the level of reporting proposed.

ATTACHMENT B

Guidance Material

Title	Web address
Relevant Legislation	
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
Protection of the Environment Operations (Clean Air) Regulation 2010	http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+428+2010+cd+0+N
Licensing	
Guide to Licensing	http://www.epa.nsw.gov.au/resources/licensing/licensing-guide-160369.pdf
Air Issues	
Air Quality	
Approved methods for the Modelling and Assessment of Air Pollutants in NSW (2016)	http://www.epa.nsw.gov.au/resources/epa/approved-methods-for-modelling-and-assessment-of-air-pollutants-in-NSW-160666.pdf
Approved methods for the Sampling and Analysis of Air Pollutants in NSW (2016)	http://www.epa.nsw.gov.au/resources/air/07001amsaap.pdf
POEO (Clean Air) Regulation 2010	http://www.legislation.nsw.gov.au/maintop/view/inforce/subordleg+428+2010+cd+0+N
Noise and Vibration	
Interim Construction Noise Guideline (DECC, 2009)	http://www.epa.nsw.gov.au/resources/noise/09265cng.pdf
Assessing Vibration: a technical guideline (DEC, 2006)	http://www.epa.nsw.gov.au/resources/noise/vibrationguide0643.pdf
Australian and New Zealand Environment Council – Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZEC, 1990)	http://www.epa.nsw.gov.au/resources/noise/ANZECBlasting.pdf
NSW Industrial Noise Policy	http://www.epa.nsw.gov.au/resources/noise/ind_noise.pdf
NSW Road Noise Policy (DECCW, 2011)	http://www.epa.nsw.gov.au/resources/noise/2011236nswroadnoisepolicy.pdf
Waste	
Waste Classification Guidelines (EPA, 2014)	http://www.epa.nsw.gov.au/wasteregulation/classify-guidelines.htm
Resource recovery exemption	http://www.epa.nsw.gov.au/wasteregulation/recovery-exemptions.htm
Water and Soils	
Soils – general	
Soil and Landscape Issues in Environmental Impact Assessment (DLWC 2000)	http://www.dnr.nsw.gov.au/care/soil/soil_pubs/pdfs/tech_rep_34_new.pdf

Title	Web address
Managing urban stormwater: soils and construction, vol. 1 (Landcom 2004) and vol. 2 (A. Installation of services; B Waste landfills; C. Unsealed roads; D. Main Roads; E. Mines and quarries) (DECC 2008)	Vol 1 - Available for purchase at http://www.landcom.com.au/whats-new/publications-reports/the-blue-book.aspx Vol 2 - http://www.environment.nsw.gov.au/stormwater/publications.htm
Landslide risk management guidelines	http://www.australiangeomechanics.org/resources/downloads/
Site Investigations for Urban Salinity (DLWC, 2002)	http://www.environment.nsw.gov.au/resources/salinity/booklet3siteinvestigationsforurbansalinity.pdf
Local Government Salinity Initiative Booklets	http://www.environment.nsw.gov.au/salinity/solutions/urban.htm
Water	
Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	http://www.mincos.gov.au/publications/australian_and_new_zealand_guidelines_for_fresh_and_marine_water_quality
Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones	http://deccnet/water/resources/AWQGuidance7.pdf
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	http://www.epa.nsw.gov.au/resources/legislation/approvedmethods-water.pdf

Heritage Council of New South Wales

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Parramatta NSW 2150
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File No: EF17/9967
Ref No: DOC17/427040

Genevieve Seed
Senior Planning Officer - Resource Assessments
Department of Planning & Environment
23-33 Bridge Street
SYDNEY NSW 2000

E-mail:Genevieve.Seed@planning.nsw.gov.au

Dear Ms Seed

Request for Secretary's Environmental Assessment Requirements (SEARs) for Sancrox Quarry Extension Project (SSD 7293).

Reference is made to your correspondence received on 17 August 2017 requesting SEARs input from the Heritage Council of NSW (the Heritage Council) for the above proposal.

After a review of the documentation, it appears that the proposed State Significant Development (SSD) site does not include any items on the State Heritage Register. However, it is noted that an early grave is identified from the National Trust Register in the suburb of Sancrox and this area may have other historical archaeological potential associated with the development of the settlement of Port Macquarie Hastings Council LGA which requires consideration and management.

It is recommended that although the Proponent did not identify heritage as an issue, the following additional SEARS are included to address this potential:

- The Environmental Impact Statement (EIS) should identify if there are any potential heritage items within the proposed project area including historical archaeological potential. If any potential heritage items are likely to be affected, a Heritage Impact Statement (HIS) must be prepared in accordance with the guidelines in the NSW Heritage Manual 1996. The HIS should assess how the development would impact on any places of heritage significance in or surrounding the SSD site.
- A historical archaeological assessment should be prepared by a suitably qualified historical archaeologist in accordance with the Heritage Division, Office of Environment and Heritage Guidelines *'Assessing Significance for Historical Archaeological Sites and 'Relics'* 2009. This assessment should identify what relics, if any, are likely to be present, assess their significance and consider the impacts from the proposal on this potential resource. Where harm is likely to occur, it is recommended that the significance of the relics be considered in determining an appropriate mitigation strategy. If harm cannot be avoided in whole or part, an appropriate Research Design and Excavation Methodology should also be prepared to guide any proposed excavations.

If you have any questions regarding the above matter, please contact Felicity Barry, Senior Archaeologist, at the Heritage Division, Office of Environment and Heritage on telephone (02) 9995 6914 or by e-mail: Felicity.Barry@environment.nsw.gov.au.

Yours sincerely

25/08/2017
Katrina Stankowski
Acting Manager, Listings
Heritage Division
Office of Environment & Heritage
As Delegate of the Heritage Council of NSW

NSW GOVERNMENT | Office of Environment & Heritage

Our Ref: DOC17/428839
Your Ref: SSD 7293

Ms Genevieve Seed
Senior Planning Officer
Department of Planning & Environment
GPO Box 39
Sydney NSW 2001

Dear Ms Seed

Re: Request for OEH Environmental Assessment Requirements – Hanson Construction Materials Pty Ltd Sancrox Quarry Extension, within the Port Macquarie Hasting Council Local Government Area (SSD 7293)

Thank you for your e-mail of 18 August 2017 inviting input from the Office of Environment and Heritage (OEH) for the preparation of Secretary's Environmental Assessment Requirements (SEARs) for the Sancrox Quarry Extension proposal. I appreciate the opportunity to provide advice.

The OEH notes that the proposal will be assessed as State Significant Development/Infrastructure in accordance with Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Environmental Impact Statement (EIS) SEARs provided by OEH are limited to Aboriginal cultural heritage, biodiversity, OEH estate, historic heritage, acid sulphate soils, flooding, stormwater and coastal erosion.

We also advise that the OEH SEARs, as it relates to biodiversity, have been issued with respect to the *Biodiversity Conservation Act 2016.*

The proponent should ensure that the EIS will be sufficiently comprehensive to enable unambiguous determination of the extent of the direct and indirect impact(s) of the proposal. The EIS should include an appropriate assessment of the potential impacts on biodiversity (threatened species, ecological communities, or their habitat), and Aboriginal cultural heritage. OEH considers that this information is necessary to assess an EIS for the proposal.

The full lists of OEH's standard and project specific requirements that may need to be addressed in the EIS are provided in **Attachment A** and **Attachment B** respectively. In preparing the EIS, the proponent should refer to the relevant guidance material listed in **Attachment C.**

If you have any further questions about this issue, Ms Rachel Binskin, Regional Operations Officer, Regional Operations, OEH, can be contacted on 6659 8247or at rachel.binskin@environment.nsw.gov.au.

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www.environment.nsw.gov.au

Yours sincerely

7.9.17

KRISTER WAERN
A/Senior Team Leader Planning, North East Region
Regional Operations

Contact officer: RACHEL BINSKIN
6659 8247

Enclosure: Attachment A – OEH Standard Environmental Assessment Requirements, Attachment B – OEH Project Specific Requirements, and Attachment C – Guidelines Materials

Attachment A – OEH Standard Environmental Assessment Requirements (SSD 7036)

Biodiversity
1. Biodiversity impacts related to the proposed project are to be assessed in accordance with the Biodiversity Offset Scheme (BOS), and documented in a Biodiversity Development Assessment Report (BDAR) in accordance with Part 6 of the *Biodiversity Conservation Act 2016* (BC Act). The BDAR is to be prepared by a person accredited in accordance with s6.10 of the BC Act.
Aboriginal cultural heritage
2. The EIS must identify and describe the Aboriginal cultural heritage values that exist across the whole area that will be affected by the project and document these in the EIS. This may include the need for surface survey and test excavation. The identification of cultural heritage values should be guided by the *Guide to investigating, assessing and reporting on Aboriginal Cultural Heritage in NSW* (DECCW, 2011) and consultation with OEH regional officers.
3. Where Aboriginal cultural heritage values are identified, consultation with Aboriginal people must be undertaken and documented in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW). The significance of cultural heritage values for Aboriginal people who have a cultural association with the land must be documented in the EIS.
4. Impacts on Aboriginal cultural heritage values are to be assessed and documented in the EIS. The EIS must demonstrate attempts to avoid impact upon cultural heritage values and identify any conservation outcomes. Where impacts are unavoidable, the EIS must outline measures proposed to mitigate impacts. Any objects recorded as part of the assessment must be documented and notified to OEH.
Historic heritage
5. The EIS must provide a heritage assessment including but not limited to an assessment of impacts to *State and local heritage* including conservation areas, natural heritage areas, places of Aboriginal heritage value, buildings, works, relics, gardens, landscapes, views, trees should be assessed. Where impacts to State or locally significant heritage items are identified, the assessment shall: a. outline the proposed mitigation and management measures (including measures to avoid significant impacts and an evaluation of the effectiveness of the mitigation measures) generally consistent with the NSW Heritage Manual (1996), b. be undertaken by a suitably qualified heritage consultant(s) (note: where archaeological excavations are proposed the relevant consultant must meet the NSW Heritage Council's Excavation Director criteria), c. include a statement of heritage impact for all heritage items (including significance assessment), d. consider impacts including, but not limited to, vibration, demolition, archaeological disturbance, altered historical arrangements and access, landscape and vistas, and architectural noise treatment (as relevant), and e. where potential archaeological impacts have been identified develop an appropriate archaeological assessment methodology, including research design, to guide physical archaeological test excavations (terrestrial and maritime as relevant) and include the results of these test excavations.

Water and soils

6. The EIS must map the following features relevant to water and soils including:
   a. Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map).
   b. Rivers, streams, wetlands, estuaries (as described in s4 of the Biodiversity Assessment Method as part of the Landscape Context).
   c. Groundwater.
   d. Groundwater dependent ecosystems.
   e. Proposed intake and discharge locations.

7. The EIS must describe background conditions for any water resource likely to be affected by the project, including:
   a. Existing surface and groundwater.
   b. Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations.
   c. Water Quality Objectives (as endorsed by the NSW Government http://www.environment.nsw.gov.au/ieo/index.htm) including groundwater as appropriate that represent the community's uses and values for the receiving waters.
   d. Indicators and trigger values/criteria for the environmental values identified at (c) in accordance with the ANZECC (2000) Guidelines for Fresh and Marine Water Quality and/or local objectives, criteria or targets endorsed by the NSW Government.

8. The EIS must assess the impacts of the project on water quality, including:
   a. The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the project protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction.
   b. Identification of proposed monitoring of water quality.

9. The EIS must assess the impact of the project on hydrology, including:
   a. Water balance including quantity, quality and source.
   b. Effects to downstream rivers, wetlands, estuaries, marine waters and floodplain areas.
   c. Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems.
   d. Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches).
   e. Changes to environmental water availability, both regulated/licensed and unregulated/rules-based sources of such water.
   f. Mitigating effects of proposed stormwater and wastewater management during and after construction on hydrological attributes such as volumes, flow rates, management methods and re-use options.
   g. Identification of proposed monitoring of hydrological attributes.

Flooding and coastal erosion

10. The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including:
    a. Flood prone land
    b. Flood planning area, the area below the flood planning level.
    c. Hydraulic categorisation (floodways and flood storage areas).
11. The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 1 in 10 year, 1 in 100-year flood levels and the probable maximum flood, or an equivalent extreme event.
12. The EIS must model the effect of the proposed project (including fill) on the flood behaviour under the following scenarios:
    a. Current flood behaviour for a range of design events as identified in 8) above. The 1 in 200 and 1 in 500-year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.
13. Modelling in the EIS must consider and document:
    a. The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood.
    b. Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other developments or land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulic categories.
    c. Relevant provisions of the NSW Floodplain Development Manual 2005.
14. The EIS must assess the impacts on the proposed project on flood behaviour, including:
    a. Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.
    b. Consistency with Council floodplain risk management plans.
    c. Compatibility with the flood hazard of the land.
    d. Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.
    e. Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.
    f. Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.
    g. Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council.
    h. Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council.
    i. Emergency management, evacuation and access, and contingency measures for the development considering the full range or flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the SES.
    j. Any impacts the development may have on the social and economic costs to the community as consequence of flooding.

Attachment B – OEH Project-specific Environmental Assessment Requirements (SSD 7036)

Biodiversity

1. The species listed below as 1(a) and (b) are to be included, as part of the 'potential' serious and irreversible impacts, on other threatened entities as part of s10.2.1.5 of the *Biodiversity Assessment Method 2017* (BAM), not listed in the *Guidance and criteria to assist a decision maker to determine a serious and irreversible*. Should one of these entities be identified during survey, the proponent is required to provide additional information in accordance with section 10.2 of the BAM.
    a. *Dendrobium melaleucaphilum* – Spider Orchid
    b. *Phaius australis* – Southern Swamp Orchid
2. The EIS is to include relevant local planning undertaken by the Port Macquarie - Hastings Council for the Greater Sancrox Area, in the context of the greater landscape to assess existing, and future habitat connectivity, especially in regards to alignment of subregional corridors, and local habitat linkages in accordance with s4.2.1.3 (d) of the BAM.

Aboriginal cultural heritage

3. The assessment of cultural heritage values must include a surface survey undertaken by a qualified archaeologist in areas with potential for subsurface Aboriginal deposits. The result of the surface survey is to inform the need for targeted test excavation to better assess the integrity, extent, distribution, nature and overall significance of the archaeological record. The results of surface surveys and test excavations are to be documented in the EIS.
4. The EIS must outline procedures to be followed if Aboriginal objects are found at any stage of the life of the proposal to formulate appropriate measures to manage unforeseen impacts.
5. The EIS must outline procedures to be followed in the event Aboriginal burials or skeletal material is uncovered during construction to formulate appropriate measures to manage the impacts to this material.

Flooding and coastal erosion

6. The EIS must consider the effects of sea level rise on all flood risks on the site under the following scenarios:
    a. Current sea level.
    b. Projected sea levels in 2050 and 2100 which have been peer-reviewed and widely accepted by scientific opinion.

Attachment C – OEH Guidance Material (SSD 7036)

Title	Web address
Relevant Legislation	
Biodiversity Conservation Act 2016	https://www.legislation.nsw.gov.au/~/view/act/2016/63/full
Coastal Management Act 2016	https://www.legislation.nsw.gov.au/~/view/act/2016/20
Commonwealth Environment Protection and Biodiversity Conservation Act 1999	http://www.austlii.edu.au/au/legis/cth/consol_act/epabca1999588/
Environmental Planning and Assessment Act 1979	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+203+1979+cd+0+N
Fisheries Management Act 1994	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+38+1994+cd+0+N
Marine Parks Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+64+1997+cd+0+N
National Parks and Wildlife Act 1974	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+80+1974+cd+0+N
Protection of the Environment Operations Act 1997	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+156+1997+cd+0+N
Water Management Act 2000	http://www.legislation.nsw.gov.au/maintop/view/inforce/act+92+2000+cd+0+N
Wilderness Act 1987	http://www.legislation.nsw.gov.au/viewtop/inforce/act+196+1987+FIRST+0+N
Biodiversity	
Biodiversity Conservation Regulation 2017	https://www.legislation.nsw.gov.au/~/view/regulation/2017/432
Biodiversity Conservation (Savings and Transitional) Regulation 2017	https://www.legislation.nsw.gov.au/~/view/regulation/2017/433
Biodiversity Assessment Method (OEH, 2017)	http://www.environment.nsw.gov.au/biodiversity/assessmentmethod.htm
Online Biodiversity Assessment Method Calculator	https://www.lmbc.nsw.gov.au/bamcalc
Serious and irreversible impact (OEH, 2017)	http://www.environment.nsw.gov.au/biodiversity/seriousirreversibleimpacts.htm
Offset Rules	http://www.environment.nsw.gov.au/biodiversity/offsetrules.htm
Fisheries NSW policies and guidelines	http://www.dpi.nsw.gov.au/fisheries/habitat/publications/policies,-guidelines-and-manuals/fish-habitat-conservation
List of national parks	http://www.environment.nsw.gov.au/NationalParks/parksearchatoz.aspx
Revocation, re-categorisation and road adjustment policy (OEH, 2012)	http://www.environment.nsw.gov.au/policies/RevocationOfLandPolicy.htm
Guidelines for developments adjoining land and water managed by the Department of Environment, Climate Change and Water (DECCW, 2010)	http://www.environment.nsw.gov.au/protectedareas/developmntadjoiningdecc.htm
Heritage	

Title	Web address
The Burra Charter (The Australia ICOMOS charter for places of cultural significance)	http://australia.icomos.org/wp-content/uploads/The-Burra-Charter-2013-Adopted-31.10.2013.pdf
Statements of Heritage Impact 2002 (HO & DUAP)	http://www.environment.nsw.gov.au/resources/heritagebranch/heritage/hmstatementsofhi.pdf
NSW Heritage Manual (DUAP) (scroll through alphabetical list to 'N')	http://www.environment.nsw.gov.au/Heritage/publications/
Aboriginal Cultural Heritage	
Aboriginal Cultural Heritage Consultation Requirements for Proponents (DECCW, 2010)	http://www.environment.nsw.gov.au/resources/cultureheritage/commconsultation/09781ACHconsultreq.pdf
Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW, 2010)	http://www.environment.nsw.gov.au/resources/cultureheritage/10783FinalArchCoP.pdf
Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011)	http://www.environment.nsw.gov.au/resources/cultureheritage/20110263ACHguide.pdf
Aboriginal Site Recording Form	http://www.environment.nsw.gov.au/resources/parks/SiteCardMainV1_1.pdf
Aboriginal Site Impact Recording Form	http://www.environment.nsw.gov.au/resources/cultureheritage/120558asirf.pdf
Aboriginal Heritage Information Management System (AHIMS) Registrar	http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm
Care Agreement Application form	http://www.environment.nsw.gov.au/resources/cultureheritage/20110914TransferObject.pdf
Water and Soils	
Acid sulphate soils	
Acid Sulfate Soils Planning Maps via Data NSW	http://data.nsw.gov.au/data/
Acid Sulfate Soils Manual (Stone et al. 1998)	http://www.environment.nsw.gov.au/resources/epa/Acid-Sulfate-Manual-1998.pdf
Acid Sulfate Soils Laboratory Methods Guidelines (Ahern et al. 2004)	http://www.environment.nsw.gov.au/resources/soils/acid-sulfate-soils-laboratory-methods-guidelines.pdf This replaces Chapter 4 of the Acid Sulfate Soils Manual above.
Flooding and Coastal Erosion	
Reforms to coastal erosion management	http://www.environment.nsw.gov.au/coasts/coastalerosionmgmt.htm
Floodplain development manual	http://www.environment.nsw.gov.au/floodplains/manual.htm
Guidelines for Preparing Coastal Zone Management Plans	Guidelines for Preparing Coastal Zone Management Plans http://www.environment.nsw.gov.au/resources/coasts/130224CZMPGuide.pdf
NSW Climate Impact Profile	http://climatechange.environment.nsw.gov.au/
Climate Change Impacts and Risk Management	Climate Change Impacts and Risk Management: A Guide for Business and Government, AGIC Guidelines for Climate Change Adaptation
Water	
Water Quality Objectives	http://www.environment.nsw.gov.au/ieo/index.htm

Title	Web address
ANZECC (2000) Guidelines for Fresh and Marine Water Quality	www.environment.gov.au/water/publications/quality/australian-and-new-zealand-guidelines-fresh-marine-water-quality-volume-1
Applying Goals for Ambient Water Quality Guidance for Operations Officers – Mixing Zones	http://deccnet/water/resources/AWQGuidance7.pdf
Approved Methods for the Sampling and Analysis of Water Pollutant in NSW (2004)	http://www.environment.nsw.gov.au/resources/legislation/approvedmethods-water.pdf

NSW RURAL FIRE SERVICE

The Secretary
NSW Planning & Environment
GPO Box 39
Sydney NSW 2001

Your Ref: SSD 7293
Our Ref: D15/2871
DA17082308907 AB

ATTENTION: Genevieve Seed

31 August 2017

Dear Ms Seed,

Request for Secretary's Environmental Assessment Requirements - Sancrox Quarry Extension

I refer to your email from the NSW Department of Planning & Environment dated 17 August 2017 seeking comment from the NSW Rural Fire Service on matters to be included in the Secretary's Environmental Assessment Requirements for the proposed Sancrox Quarry extension.

The subject land is mapped as bushfire prone land by Port Macquarie - Hastings Council. The NSW Rural Fire Service considers that the environmental assessment for the proposed development should address the following:

- the aim and objectives of 'Planning for Bushfire Protection 2006';
- identification of bush fire prone land within 140 metres of the proposed development;
- identification of potential ignition sources during construction and operation of the development;
- storage of fuels and other hazardous materials (e.g. explosives for blasting);
- stockpiling of any mulched vegetation;
- proposed bushfire protection measures for the development, including vegetation management and fire suppression capabilities;
- operational access for fire fighting appliances to the site; and
- emergency and evacuation planning.

Postal address
Records
NSW Rural Fire Service
Locked Bag 17
GRANVILLE NSW 2142

Street address
NSW Rural Fire Service
Planning and Environment Services (North)
Suite 1, 129 West High Street
COFFS HARBOUR NSW 2450

T (02) 6691 0400
F (02) 6691 0499
www.rfs.nsw.gov.au
Email: pes@rfs.nsw.gov.au

For any queries regarding this correspondence please contact Alan Bawden on 6691 0400.

Yours sincerely,

Ian Cook
Acting Manager – Planning and Environment Services North
The RFS has made getting information easier. For general information on 'Planning for Bush Fire Protection, 2006', visit the RFS web page at www.rfs.nsw.gov.au and search under 'Planning for Bush Fire Protection, 2006'.

File No: NTH12/00067/06
Your Ref: SSD_7293

The Manager
Department of Planning and Environment
GPO Box 39
SYDNEY NSW 2001

Attention: Genevieve Seed – Senior Planning Officer

Dear Sir / Madam,

Secretary's Environmental Assessment Requirements for SSD 7293 – Sancrox Quarry, Sancrox Road, Sancrox

I refer to your email of 17 August 2017 requesting an updated to the Secretary's Environmental Assessment Requirements (EARs) for the abovementioned state significant development.

Roles and Responsibilities

The key interests for Roads and Maritime Services are the safety and efficiency of the road network, traffic management, the integrity of infrastructure assets and the integration of land use and transport.

Port Macquarie-Hastings Council is the Roads Authority for all public roads in the subject area pursuant to Section 7 of the *Roads Act 1993* Roads and Maritime is the roads authority for freeways and can exercise road authority functions for classified roads in accordance with the Roads Act. Council is responsible setting standards, determining priorities and carrying out works on public (local) roads.

Roads and Maritime Response

Roads and Maritime requests that the Environmental Assessment be supported by a Traffic Impact Assessment (TIA) prepared by a suitably qualified person in accordance with the Austroads Guide to Traffic Management Part 12, the complementary Roads and Maritime Supplement and RTA Guide to Traffic Generating Developments. The TIA is to address the following;

- The total impact of existing and proposed development on the road network with consideration for a 10 year horizon.
- The volume and distribution of traffic generated by the proposed development.
- Intersection sight distances at key intersections along the primary haul route.
- Existing and proposed site access standards.
- Details of proposed improvements to affected intersections.
- Details of servicing and parking arrangements.

- Impact on public transport (public and school bus routes) and consideration for alternative transport modes such as walking and cycling.
- Impacts of road traffic noise and/or dust generated along the primary haul route/s.
- Consideration for Clause 16(1) of the Mining SEPP regarding;
    - Impact on school zones and residential areas.
    - Code of Conduct for haulage operators
    - Road safety assessment of key haulage route/s

  Should Council wish to condition the preparation of a Code of Conduct for haulage operators, this could include, but not be limited to;

    a. A map of the primary haulage routes highlighting critical locations.
    b. Safety initiatives for haulage through residential areas and/or school zones.
    c. An induction process for vehicle operators & regular toolbox meetings.
    d. A complaint resolution and disciplinary procedure.
    e. Any community consultation measures for peak haulage periods.

Where road safety concerns are identified at a specific location along the identified haulage route/s, Roads and Maritime suggests that the TIA be supported by a targeted Road Safety Audit undertaken by suitably qualified persons.

The current Austroads Guidelines, Australian Standards and Roads and Maritime Supplements are to be adopted for any proposed works on the classified road network.

The Developer would be required to enter into a 'Works Authorisation Deed' (WAD) with Roads and Maritime for any works deemed necessary on the classified road network. The developer would be responsible for all costs associated with the works and administration for the WAD. Further information on undertaking private developments adjacent to classified roads can be accessed at:

http://www.rms.nsw.gov.au/projects/planning-principles/index.html

Advice to the Consent Authority

Roads and Maritime highlights the Consent Authority is responsible for considering the environmental impacts of any road works which are ancillary to the development. This includes any works which form part of the proposal and/or any works deemed necessary to include as requirements in the conditions of development consent.

If you have any further enquiries regarding the above comments please contact Bill Butler, A / Manager Land Use Assessment on (02) 6640 1362 or via email at: development.northern@rms.nsw.gov.au

Yours faithfully

W.R Butler

for Liz Smith
A / Network & Safety Manager, Northern Region

Port Macquarie-Hastings Council
PO Box 84
Port Macquarie
NSW Australia 2444
DX 7415
e council@pmhc.nsw.gov.au

ABN 11 236 901 601

PORT MACQUARIE HASTINGS COUNCIL

21 August 2017

Refers to: CRM 16196/2017
Your Ref: SSD 7293
Parcel No.: 18314, 18327, 28897 & 28898

Genevieve Seed
Senior Planning Officer
GPO Box 39
SYDNEY NSW 2001
genevieve.seed@planning.nsw.gov.au

Dear Genevieve

Updated Secretary's Environmental Assessment Requirements (SEARs) for Sancrox Quarry Extension Project (SSD 7293) at Sancrox Road, Sancrox

I refer to your email to Council dated 17 August 2017 regarding the above matter.

Please be advised that Council staff have reviewed the current proposal, the SEARs issued on 19 October 2015 and the previous requirements of the other Government Departments. A summary of the key Council matters for consideration include:

- The property is largely zoned RU1 Primary Production under the Port Macquarie Hastings Local Environmental Plan 2011. However, Lot 1 DP 704890 also contains IN1 General Industrial and SP2 Special Purposes zoning. Proposal to address permissibility of the quarry and associated aspects.
- Compliance with State Environmental Planning Policy (State and Regional Development) 2011 to be outlined.
- State Environmental Planning Policy No 33 - Hazardous and Offensive Development to be considered.
- State Environmental Planning Policy No 44 – Koala Habitat Protection to be considered.
- State Environmental Planning Policy No 55 – Remediation of Land to be considered.
- State Environmental Planning Policy No 62 – Sustainable Aquaculture to be considered given proximity to Hastings River and tributaries.
- State Environmental Planning Policy No 64 – Advertising and Signage to be considered if any signage proposed (ie quarry business identification signs).
- State Environmental Planning Policy No 71 – Coastal Protection applies to part of the land and is therefore to be considered.
- State Environmental Planning Policy (Infrastructure) 2007 to be considered. In particular, Division 17, Subdivision 2 provisions.
- State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007 to be considered.
- State Environmental Planning Policy (Rural Lands) 2007 to be considered.
- Proposal to have regard for the Port Macquarie Hastings Local Environmental Plan 2011 (LEP 2011).

PORT MACQUARIE OFFICE
17 Burrawan Street, Port Macquarie NSW 2444
t 02 6581 8111 f 02 6581 8123

WAUCHOPE OFFICE
49 High Street, Wauchope NSW 2446
t 02 6589 6500

LAURIETON OFFICE
9 Laurie Street, Laurieton NSW 2443
t 02 6559 9958

Parcel No.: 18314, 18327, 28897 & 28898

- Lot 2 DP 574308 contains potential acid sulphate soils and is flood prone. These aspects will need to be addressed.
- Proposal should consider consolidating all the parcels of land into one lot.
- Noise, air and vibration impacts from the quarry operations, concrete batching plant etc and associated flow on activities (ie truck movements) to be addressed. Any proposed buffers will need to be contained on the quarry site or an agreement in place with impacted neighbours.
- The applicant is to contact Council's Contribution Section to ascertain if any s94A contributions, s64 contributions and/or Voluntary Planning Agreement (VPA) is required to address impacts associated with the extension.
- Details of any staging to be included in the application.
- Details of any rehabilitation and final use to be detailed in the application.
- Confirmation on what will happen to the existing consents applying to the site, including their rehabilitation and proposed final use.
- Proposal to address potential fly rock impacts on surrounding industrial and rural residential land. Any proposed buffers will need to be contained on the quarry site or an agreement in place with impacted neighbours.
- Traffic impact assessment should be required.
- Proposal to detail any existing structures/buildings to be retained and or demolished.
- Consideration should be given to closing and obtaining all of the Crown Road that traverses the site, not just the northern section.
- Stormwater management plan required.
- All processes involved in the quarry, batching plants etc to be detailed in the EIS.
- The application is to outline the proposed water and sewer supply with any connection to Council's reticulated system requiring Council approval.
- At this stage, the Sancrox area is also being considered by Council as a potential long term urban growth area.

Should you have any questions in relation to the above, please call me on 65818538 or email clinton.tink@pmhc.nsw.gov.au.

Yours sincerely

Clinton Tink
Development Assessment Planner

APPENDIX B

Methods Statement

APPENDIX B

Field Survey Details

1 Overview

The following field surveys were conducted as part of preparation of the Biodiversity Assessment Report (BAR) for the proposed Sancrox Quarry Expansion State Significant Development. The survey methods and effort were generally in accordance with the relevant sections of the *Framework for Biodiversity Assessment* ('FBA'; OEH 2014):

- Threatened species surveys, in accordance with Section 6.6 of the FBA, as follows:
  - A targeted survey for locally occurring threatened orchid species, conducted during the flowering periods of candidate threatened orchid species by an SLR Principal Ecologist on the 16 October 2015;
  - a five-day four-night survey for threatened fauna species conducted by two SLR ecologists from 30 November – 4 December 2015;
  - an additional threatened species survey over one-night and one day, conducted by one SLR ecologist between 14 and 15 December 2015, to meet recommended survey effort for a selection of potentially occurring threatened species;
- a plot-based full floristic survey (or 'plot/transect survey') of the Development Site, conducted by two SLR ecologists over two days, to collect site value data for vegetation condition and habitat values, according to Section 5.2 of the FBA.

Further details of the above survey techniques and survey effort are provided below.

2 Assessing Site Value

2.1 Mapping native vegetation extent

Patches of native vegetation were identified on the site prior to field work using available regional vegetation data for the Northern Rivers catchment and for Port Macquarie-Hastings LGA and aerial imagery. Broad vegetation formations and vegetation classes were mapped across the site and their areas calculated. This mapping allowed a field survey design to be completed, and formed the starting point for identifying native vegetation types.

These patches were assessed during field surveys to ascertain the extent, type and distribution of native vegetation types within these patches. Other parts of the site, including especially those where the proposed PPUs are located, were inspected on foot or driven to determine whether additional areas of native vegetation are present. In accordance with the Biobanking Methodology (DECC 2009) "*Cleared land is land on which the native over-storey has been cleared, there is no native mid-storey, and less than 50% of the ground cover vegetation is indigenous species, or greater than 90% of the ground cover is cleared*".

Subsequent to field work the OEH (2011) vegetation mapping was reviewed. Detailed consideration was given to methods used in that mapping (eg validation effort, patch size, canopy cover) and it was determined that whilst various additional patches of native vegetation are included in that vegetation the field efforts by SLR are most reliable in determining the presence of vegetation patches across the site.

2.2 Stratifying native vegetation

Based on field survey results, vegetation types (or plant community types, PCTs) were identified by matching floristic results from plot surveys (see next section) to floristic descriptions for relevant vegetation types listed for the Northern Rivers CMA in the *NSW Vegetation Types Database* (OEH, 2012). Patches of native vegetation types were further stratified into broad condition states of 'low' condition and 'moderate to good condition' (definitions as per DECC 2009a and thereby identified as distinct vegetation zones, according to Section 5.2.2 of the FBA. Vegetation zones are mapped and described in the accompanying report.

2.3 Plot and transect surveys

A plot-based full floristic survey of the development site was undertaken according to the methods outlined in Chapter 5 of the FBA. Plot and transect surveys were conducted to gather data on 'site value' for each vegetation zone and sample the environmental variation encountered within each zone. The number of plots sampled per vegetation zone was done according to the minimum requirements of the FBA, as listed in **Table 1**.

Table 1 Plots/transects required and collected per vegetation zone

Vegetation zone name	Vegetation type name	Total area (ha)	Minimum plots	Plots done
NR117_Moderate/Good	Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion	0.55	1	1
NR247_Moderate/Good	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	10.61	3	3
NR263_Moderate/Good	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	30.32	4	4
NR263_Moderate/Good_Poor	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	1.37	1	1
NR247_Moderate/Good_Poor	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	0.25	1	1
	Total:	**43.10**	**10**	**10**

As listed in Table 1, the minimum number of plots/transects was completed for each vegetation zone.

The surveys were standard biobanking plot surveys (see DECC 2009 and OEH 2014) and involved

- Establishing a plot location randomly within a given vegetation zone, based on marking points randomly within each zone on a map of vegetation types. The locations of all plot/transects are shown in **Figure 8** of the BAR;
- A full floristic survey based on a 'nested' 20 m X 20 m quadrat, with all species recorded within the plot, including species name, growth form, and cover-abundance score according to the Braun-Blanquet scoring system (see Poore 1955)
- Establishing a 50 m transect through the centre of the plot and collecting data on six variables at various intervals along the transect (as listed in Table 2 of the FBA). The start point of the 50 m transect was recorded using a hand held GPS unit to allow mapping of the locations of all plot/transects;
- Establishing a 20 m X 50 m plot using the boundaries of the 20 m X 20 m plot and the 50 m transect, and recording (i) total length of fallen logs (>10 cm diameter and over 50 cm in length) and (ii) number of trees with hollows;
- Estimating the proportion of canopy trees that are regenerating within the zone.

The above data were collected using biobanking field sheets (DECC 2009b). The completed field data sheets are attached to the accompanying report in **Appendix C**.

3 Threatened Species Surveys

3.1 Overview

A range of threatened species have previously been recorded within the locality of the site. Section 6.6 of the FBA specifies the requirements for threatened species surveys:

- should be carried out at the appropriate time of year, as specified in the Threatened Species Profile Database;
- adopt repeatable methods
- must target all 'candidate' species credit species identified according to Section 6.5 of the FBA.
- Be conducted according to DEC (2004) guidelines for all species excluding frogs (see below); and
- For frogs, be conducted according to DECC (2009) guidelines.

Based on our search for previous records of threatened species in the Atlas of NSW Wildlife database (within 10 km of the site), we have generated a table listing threatened flora and fauna for consideration in the BAR. The table is provided in Appendix A and provides the recommended survey techniques and survey effort for each of group of threatened fauna. In identifying survey requirements for the BAR, we have relied on the following key guidelines:

- DEC (2004) Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities, for threatened species (excluding frogs) listed under the TSC Act.
- DECC (2009) Threatened species survey and assessment guidelines: field survey methods for fauna. Amphibians, for threatened frogs listed under the TSC Act.
- DEWHA survey guidelines for Australia's threatened birds, bats, frogs and mammals, for threatened fauna listed under the EPBC Act.

In the SEARs, OEH have also identified threatened species 'requiring further consideration' in the BAR, as noted above, which are the threatened plants *Melaleuca biconvexa*, *Dendrobium melaleucaphilum* and *Phaius australis*.

The aim of the surveys was to gather site data and observations to inform this *Biodiversity Assessment Report* and involved:

- inspecting areas of native vegetation to refine vegetation community mapping and conditions in accordance with the FBA (OEH 2014);
- collection of detailed floristic and habitat data within the plant community types in accordance with the requirements of the BioBanking methodology;
- Spotlighting surveys throughout bushland areas and around waterbodies to detect nocturnal fauna species
- Call playback of relevant threatened forest owls and threatened amphibian calls during nocturnal surveys.
- Infrared and motion sensing camera surveys across various woodland habitats on the site to detect ground mammals and other fauna;
- Amphibian surveys (searches and call playback as well as dipnetting for tadpoles) in all waterbodies of bushland areas and quarry area.
- Anabat monitoring and Harp trapping for microchiropteran bats, focusing on areas where bat activity would be highest;
- Arboreal hairtube surveys for arboreal mammals in woodland habitats across the site;
- Glider-tube trap surveys for arboreal mammals in woodland habitats across the site;
- Elliot trap surveys for ground mammals in woodland habitats across the site;
- Cage surveys for ground mammals;

- Dawn bird surveys, in particular to target threatened species of birds known to the locality; and
- Surveys for important fauna habitat features.

3.2 Details of Survey Techniques

3.2.1 ELLIOT TRAP SURVEYS

Elliot trap surveys were conducted throughout the Site, to target threated ground mammals. Traps were set in a variety of habitats on the site including woodland on the ridge as well as gully area. Traps were placed adjacent to favourable habitat features for ground mammals such as hollow logs or dense ground vegetation. The traps were checked each morning before or on sunrise to minimize disturbance or heat stress to any captured nocturnal mammals.

Table 2 Elliot trap surveys

Date (2015)	Survey Effort (trap Nights)	Fauna groups targeted	Threatened species targeted	Comments
30 November – 3 December (4 nights)	3 transects with 10 units	Ground mammals	Rufous Bettong, Eastern Chestnut Mouse, Common Planigale	15 traps baited with peanut butter/oats/honey; 15 traps baited with meat
Total	120 TN			

3.3 Arboreal Hair Tube Surveys

Arboreal hair tube traps were installed on tree trunks throughout the site, to target threatened arboreal mammals (primarily the Brush-tailed Phascogale and Squirrel glider).

Date (2015)	Survey Effort (Trap Nights)	Fauna groups targeted	Threatened species targeted	Comments
01 December- 15 December	30 units x 14 nights	Arboreal mammals	Squirrel glider, Yellow-bellied glider, Brush-tailed Phascogale	Traps baited with peanut butter/oats/honey and attached to trees 3m above ground height.
Total	420 TN			

3.4 Glider Tube Surveys

Glider tube surveys were conducted throughout the site, to target threatened arboreal mammals. Tubes were installed on tree trunks approximately 3m above ground height and were baited with a peanut butter/oats/honey mix. Tree trunks were also sprayed with molasses liquid to attract gliders. All habitat types were surveyed including ridge top woodland and the gully woodland.

Table 3 Glider tube surveys

Date (2015)	Survey Effort (Trap Nights)	Fauna groups targeted	Threatened species targeted	Comments
01 December- 15 December	17 units x 4 nights	Arboreal mammals	Squirrel glider, Brush-tailed Phascogale	Traps baited with peanut butter/oats/honey Tubes placed 3m above ground height Tree trunks sprayed with molasses/water mixture
Total	68 TN			

3.5 Cage Trap Surveys

Cage trap surveys were conducted throughout the site, to target a range of threatened ground mammals. Priority was given to areas of the site with denser vegetation and favourable habitat features such as hollow logs. Such areas were more likely occurring in the various gullies across the site.

Table 4 Cage trap surveys

Date (2015)	Survey Effort (Trap Nights)	Fauna groups targeted	Threatened species targeted	Comments
30 November-3 December	5 units x 4 nights	Ground Mammals	Spotted-tailed Quoll, Common Planigale, Rufous Bettong, Eastern Chestnut Mouse	Traps baited with dog food and banana 2 cages set on ridge top 3 cages set in gully habitat
Total	20 TN			

3.6 Infrared Camera Surveys

Infrared cameras were set up throughout the site to target threatened ground mammals. Cameras were installed adjacent to favourable habitat features such as hollow logs or near to evidence of ground mammal activity (burrows or scratchings). Cameras are also motion sensing which allowed constant monitoring during day and night.

Table 5 Infrared Camera surveys

Date (2015)	Survey Effort (Trap Nights)	Fauna groups targeted	Threatened species targeted	Comments
30 November-3 December	5 units x 4 nights	Ground mammals	Spotted-tailed Quoll, Common Planigale, Rufous Bettong, Eastern Chestnut Mouse	Cameras baited with dog food, banana and molasses. Installed near favourable habitat features such as hollow logs.
04– 14 December-	4 units x10 nights	As above	As above	As above
Total	60 TN			

3.7 Spotlighting

Spotlighting surveys were conducted throughout the site, to target nocturnal mammals, owls, amphibians and other nocturnal fauna. All vegetation types were surveyed and special attention was given to areas of higher habitat value. Fauna species were detected both visually and aurally.

Table 6 Spotlighting surveys

Date (2015)	Survey Effort (person-hours)	Survey notes	Fauna groups targeted	Threatened species targeted
30 November (8-9pm; 9.30-10pm)	4.5	3 persons surveyed western area of site	Forest Owls, arboreal mammals, ground mammals	Powerful Owl, Sooty Owl, Masked Owl, Barking Owl, Brush-tailed Phascogale, Squirrel Glider, Yellow-bellied Glider, Grey-headed Flying-fox, Koala, Common Planigale, Spotted-tailed Quoll, Eastern Chestnut Mouse and Rufous Bettong.
01 December (9.10 – 10.30pm)	2.7	2 persons surveyed ridge top and gully near quarry	Forest Owls, arboreal mammals, ground mammals	As above
02 December (10.30- 11pm)	0.5	1 person surveyed southeast area	Forest Owls, arboreal mammals, ground mammals	As above
03 December (9-10pm)	3	3 persons surveyed northern/central area and southern gully	Forest Owls, arboreal mammals, ground mammals	As above
14 December (9-9.45pm)	1.5	2 persons surveyed western area	Forest Owls, arboreal mammals, ground mammals	As above
Total	12.2			

3.8 Call Playback

Pre-recorded calls of the Masked Owl, Powerful Owl Sooty Owl, Barking Owl, and Grass Owl were broadcast on numerous locations during the 2015 field surveys. Surveys commenced after dusk with each call being broadcast for 5 minutes followed by a two-minute listening period. Ten minutes were spent listening for calls prior to and after playback. Call playback was conducted within three hours after sunset.

Table 7 Call playback surveys

Date (2015)	Survey Effort (hrs)	Calls Broadcast	Survey Area	Comments
30 November (9.30-10pm)	1.0	Powerful Owl, Sooty Owl, Masked Owl, Grass Owl, Barking Owl	Western area of site	Broadcast during final half-hour of spotlight; 2 persons observing
01 December (9-10pm)	1.0	Powerful Owl, Sooty Owl, Masked Owl, Grass Owl, Barking Owl	Central area of site	2 persons broadcast at random throughout spotlight
02 December (10.30- 11pm)	0.5	Powerful Owl, Sooty Owl, Masked Owl, Grass Owl, Barking Owl	Southeast area of site	1 person broadcasting and spotlight
03 December (9.30-10pm)	0.5	Powerful Owl, Sooty Owl, Masked Owl, Grass Owl, Barking Owl	Central area of site	1 person broadcasting and spotlight
14 December(9.30 – 10.15)	1.5	Powerful Owl, Masked Owl, Barking Owl	Western bushland area	Broadcast during final 45 minutes of spotlight; 2 persons observing
TOTAL	**4.5 hours (5 nights)**			

3.9 Stag-watching

Table 8 Stag-watching survey effort and details

Date	Survey Effort (person-hours)	Survey notes	Fauna groups targeted	Threatened species targeted
01 December (7.40-9.10pm)	3.0	2 persons. Large grey gum and large stag near ridge	Forest owls, arboreal mammals, microchiropteran bats	Powerful Owl, Sooty Owl, Masked Owl, Barking Owl, Brush-tailed Phascogale, Squirrel Glider, Yellow-bellied Glider and microchiropteran bats.
02 December (7.30- 9pm)	3.0	2 persons. Large Blackbutt on ridge (near quarry) and large Bloodwood in western area.	As above	As above
03 December (7.30- 9 pm)	4.5	3 persons. Large Grey Gum near central disturbed area, large stag in northern area and large Grey Gum closer to Quarry.	As above	As above
14 December (7.30- 9pm)	3.0	2 persons. Large stag and large Spotted Gum, both in central northern area.	As above	As above
Total	13.5 hrs			

3.10 Amphibian Surveys

Diurnal and Nocturnal searches including broadcasts of pre-recorded calls of threatened amphibians including Green and Golden Bell Frog, Giant Barred Frog, Green-thighed Frog, Wallum Froglet. All waterbodies were surveyed including three large retention dams in quarry. Various soaks and depressions were also surveyed during rain periods. Tadpoles were surveyed for using dip-netting in shallow areas although due to the man-made nature of the waterbodies (farm and quarry dams) access was sometimes difficult and due to deep centres, only edges of waterbodies could be sampled.

Table 9 Amphibian surveys

Date	Survey Effort (person-hours)	Method	Surveyed Area	Species targeted	Comments
30 November (7 -8pm; 9-9.30pm)	4.5	Diurnal survey and call playback	Western farm dam	Green and Golden Bell Frog, Giant Barred Frog, Green-thighed Frog, Wallum Froglet	3 persons observing
01 December (5 - 6.45pm)	3.5	Diurnal survey and call playback	Large dams inside quarry	As above	2 persons observing
02 December(6-7pm & 9-10:30pm)	2	Call playback and dip netting	Western farm dam	As above	2 persons observing
02 December(9-10.30pm)	3	Dip netting, Call playback and spotlighting	central disturbed area depressions and 2 large quarry dams	As above	2 persons observing
3rd December (5:30-7:30pm)	6	Dip netting, Call playback and	Main quarry dams.	As above	3 persons observing
3rd December (9 – 9:15pm)	0.25	Brief call playback	Soak in southern gully area	Green-thighed Frog, Wallum Froglet	1 person

Date	Survey Effort (person-hours)	Method	Surveyed Area	Species targeted	Comments
14th December (6-7:30pm)	3	Diurnal searches and call playback	Two large dams in quarry and farm dam in western area	Green and Golden Bell Frog, Giant Barred Frog	2 persons observing
Total	**22.25 hrs**				

3.11 Microchiropteran Bat Surveys

Harp Traps and Anabat recorders were employed to detect microchiropteran bats. Harp Traps were placed in appropriate areas for bat detection including coastal woodland and dry sclerophyll forest. Traps were left for a minimum of two nights. Anabat recorders are useful in detecting high flying microchiropteran bats that are often under sampled by bat (harp) trapping. Anabat surveys were conducted passively using three units at stationary points from dusk until dawn.

In addition to electronic monitoring, Harp traps were deployed in various locations of the site to physically catch low-flying microchiropteran bats. Harp traps were set at dusk each night in some of the small roads/trails found across the site. These trails act as 'fly ways' for bats and are more likely to be frequented during the night.

Table 10 Microchiropteran bat surveys.

Survey Type	Date (2015)	Survey (hours)	Survey effort (Detector nights)	Area Surveyed
Anabat	30/11-01/12	(7pm -6am)	3	3 units placed in western area of site; one on edge of farm dam
	01/12-02/12	(7pm -6am)	3	As above
	02/12-03/12	(7pm -6am)	3	One unit remain at farm dam. Two units moved to woodland areas near ridge and central disturbed area.
	03/12-04/12	(7pm -6am)	3	As above except for one unit moved to large southern dam in quarry.
	TOTAL		**12 'Detector Nights'**	
Harp Trap	03/12 –	6pm -5:30am	2 trap nights	One unit near western farm dam. One unit on fire trail on ridge (eastern area).
	04/12	6pm -5:30am	2 trap nights	Same as above
	TOTAL		**4 TN**	

3.12 Avifauna Surveys

Diurnal bird surveys involved visual observation of species as well as identification of calls. Terrestrial bird surveys were conducted at dawn while aquatic bird surveys were conducted at random times of day.

In addition, bird species were also recorded on an opportunistic basis throughout all surveys.

Table 11 Avifauna surveys

Date (2015)	Survey Effort (person-hours)	Surveyed Area
01 December (5.30 -7.30am)	4	Opportunistic survey across site during trap checks at dawn. Searches for nests.
02 December (5am-7:30am)	5	Opportunistic survey across site during trap checks at dawn. Searches for nests. Active searches on ridge and in southern gully.
03 December (6am-8am)	6	Opportunistic survey across site during trap checks at dawn.
TOTAL	**15 person hours**	

3.13 Koala Spot Assessment Technique

During the SLR 2015 studies, the SPOT assessment technique was conducted in all areas and habitat types of the site. Koala scats were searched for at the bases of 30 trees within each plot (10 plots were completed). Evidence of other threatened fauna was also targeted such as, Powerful Owl roost sites and microchiropteran bat roost sites *etc*.

Table 12 Spot Assessments

Date (2015)	Survey Effort (person-hours)	Surveyed Area
02 December	6	Plots in western woodland areas (2 persons)
03 December	9	Plots in central and eastern woodland areas (3 persons)
TOTAL	**15 person hours**	

3.14 Habitat searches

During the surveys, the subject site was thoroughly examined for the occurrence of habitat features including hollow-bearing trees, dead stags, ground logs and debris as well as suitable vegetation types. Habitat features suitable for threatened species were also targeted. The presence of old growth hollows / dead stags favourable for threatened owl species were mapped and were also targeted in Spotlighting and stag-watching surveys. Field ecologists carried out random, opportunistic log and debris searches, targeting reptiles and small mammals.

The methods by which candidate 'species credit' threatened species of potential relevance to the site were identified are described in Section 4 of the accompanying BAR. Targeted surveys for species credit species were conducted, where possible for relevant species, during the January and February field surveys described above.

3.15 Weather

Weather conditions during days of the detailed survey were hot and sunny with gentle north winds (gusty at times) and intermittent occasional rainfall events ( ).

Table 13 Weather conditions during the survey period1

Date (2015)	24-hr Rainfall (mm)	Humidity (%)	Max Wind (km/hr)	Temp Range (ºC)	Moon phase
Nov 30 (diurnal)	0	68	18 S	28 clear sky	_
Nov 30 (nocturnal)	0	88	11 NNE	18 - 22	77% moon waning gibbous
Dec 01 (diurnal)	0	56	NE winds strengthening throughout morning	22 – 32 Morning fog becoming hot and sunny	_
Dec 01 (nocturnal)	0.2 evening shower	76	19 NW	20 - 24	68% moon waning gibbous
Dec 02 (diurnal)	0	88	9 W	20 – 28 overcast	_
Dec 02 (nocturnal)	2 light showers continuing overnight	76	17 S	20 - 24	58% moon waning gibbous
Dec 03 (diurnal)	20	53	24 S	23 overcast	_
Dec 03 (nocturnal)	0	62	13 SSW	16 – 19 clear sky	
Dec 04 (diurnal)					
Dec 14 (diurnal)					
Dec 14 (nocturnal)	Last rain 13mm on 10/12/15	79	19 N	20 Clear sky	10% moon waxing crescent

1 Recorded at the nearest BOM weather station (Port Macquarie, approximately 6 kilometres from Sancrox)

4 References

Cropper, SC. 1993. Management of endangered plants. CSIRO Publishing, East Melbourne.

DECC. 2009a. BioBanking Assessment Methodology and Credit Calculator Operational Manual. Department of Environment and Climate Change NSW, Sydney.

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OEH. 2012. NSW BioMetric Vegetation Types CMA. State of NSW and Office of Environment and Heritage, Sydney.

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APPENDIX C

Plot and Transect Data

No.	Species	Cover/abundance Score (see table above)
1	Carex appressa	3
2	Gahnia clarkei	4
3	Melaleuca linariifolia	3
4	Melaleuca stypheliodes	3
5	Corymbia intermedia	3
6	Lomandra longifolia	3
7	Geitonoplesium cymosum	3
8	*Cinnamomum camphora	1
9	Hibbertia scandens	2
10	Dichondra repens	2
11	Entolasia marginata	2
12	Glochid. fend. var. fend.	4
13	Echinopogon ovatus	2
14	Centella asiatica	2
15	Rubus moluc. s. trilob.	2
16	Platycerium bifurc. s. bifurc.	1
17	Pandorea pandorana	3
18	Microlaena stip. s. stip.	3
19	Phyllanthus (?) gunnii	1
20	Jagera pseudorhus	1
21	Doodia aspera	3
22	Oplismenus hirtellus	3
23	Callistemon salignus	3
24	Parsonsia straminea	2
25	Adiantum hispidulum	2
26	Smilax australis	1
27	Lophostemon confertus	4
28	Hypolaena muelleri	3
29	Euca. microcorys	3
30	Dianella caerulea	2
	Poa sieb.	2
	Glycine clandestina	2

Total species	37
Total native species	36
Total exotic species	1
% perennial native understorey cover*	80

* Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons

Viola (?) banksii 2
Myrsine variabilis 3
Euca. carnea 3
Euca. propinqua 3
Maclura cochinchinensis 2

Site value:
Transect tally table

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Northern Rivers		V. Pepper	01/12

Proposal ID	Proposal name	Zone ID
VZ1	Sancrox Quarry	VZ1 P1

Vegetation formation: Forested Wetlands

Vegetation class: Coastal Floodplain Wetlands

Vegetation type: PMVC_73 Flax-leaved Paper - Mixed Euc.

Condition (low or mod/good)	**Zone descriptor** (optional)	**Geographic/habitat features** (tick after printing step 2 of Credit Calculator)
Mod-good	Good	☐

Transect number VZ1 P1	Number of hits (tally)	%
Native over-storey cover (%)	225	22.5
Native mid-storey cover (%)	580	58
Native ground cover (grasses) (%)	29	58
Native ground cover (shrubs) (%)	2	4
Native ground cover (other) (%)	46	92
Exotic plant cover (%)	1	2

Transect number_____	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrubs) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number_____	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrub) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number_____	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover grasses (%)		
Native ground cover shrubs (%)		
Native ground cover other (%)		
Exotic plant cover (%)		

VZ1 P1

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank **Proposal ID:** VZ1 P1 **Date:** 01/12/15 **Recorder(s):** J. Peppe

Vegetation type: Flax-leaved Paperbark **AMG Zone** 56 **Easting/Northing:** 31.42544 / +152.81408 **Photos:**

Native over-storey species list At 10 points along the 50-m transect	Regeneration (√) (zone)	Native mid-storey species list (>1m to <over-storey) At 10 points along the 50-m transect	Native ground cover (grasses) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (shrubs) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (other) species list (ground stratum <1m) At 50 points along the 50-m transect	Exotic plants species list At 50 points along the 50-m transect	Fallen logs (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
5 10%	50	50%	1 1		5		2.5
10 10	50		4		5		6.0
15 10	60		3		5		6.5
20 10	60		*		3		4.0
25 20	70	→ 0	2		4		4.5
30 25	70		4		5		7.0
35 50	40		4		5	1	5.0
40 40	40		4		4		
45 40	70		4	1 1	5		
50 10	70		3	1 1	5		
225							
	0.75						
Total number of species = 37 Foliage cover (%) = Benchmark value (%FC) = Average crown diameter = Average foliage cover (%) = 22.5% Number of trees = Sample area = 20x50 **Whole zone** Number of trees with hollows = 0 Sample area = 20x50 Benchmark value =		Total no of species = 5 Foliage cover (%) = 50	Total no of species = 29 Foliage cover (%) = 58	Total no of species = 2 Foliage cover (%) = 1	Total no of species = 46 Foliage cover (%) = 92	Total no of species = 1 Foliage cover (%) = 2	Total (m) = 35.5 Benchmark (m) =

SITE AND OTHER NOTES:

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

Field data sheets for BioBanking : Biobank site proposal package February 2009

bearing 351° slope +2°

Myrsine variabilis
Eclipta platyglossa

Site value:
Transect plot data sheet

(Start a new sheet for each vegetation zone)

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Northern Ri.		J. Pepper	01/12

Proposal ID	Proposal name	Zone ID
VZ1	Sancrox Quarry	VZ1 P1

Vegetation formation: Forested Wetlands / Wet Sclerophyll Forest

Vegetation class: Coastal Floodplain Wetlands

Vegetation type: PMVC 73 Flax-leaved Paperbark PCT 686

Condition (low or mod/good): Mod-good

Zone descriptor (optional):

Geographic/habitat features (tick after printing step 2 of Credit Calculator): ☐

NR117 (686) Blackbutt - Pink Bloodwood shrubby open forest

Coordinates (GPS datum GDA94:_____)

Transect / plot number	P1	2	3	4	5	6	7	8	9	10
Easting										
Northing										
Zone AMG										

Transect 10 points along 50-m transect (see transect tally table for % foliage cover variables)

Native over-storey cover (%)	22.5									
Native mid-storey cover (%)	58									
Native ground cover (grasses) (%)	58									
Native ground cover (shrubs) (%)	4									
Native ground cover (other) (%)	92									
Exotic plant cover	2									

Larger sampling area

Native plant species richness [1]	~~37~~ 36									
Number of trees with hollows [2]	0									
Over-storey regeneration [3]	0.75									
Total length of fallen logs (m) [2]	35.5									

Comments/additional conservation values (riparian areas, special features, geology, etc.):

- Southern swamp forest patch
- Cryptostylis erecta recorded on Wedge

[1] 20 x 20 m plot [2] 20 x 50 m plot [3] whole zone

Floristic datasheet – 20 m X 20 m quadrat

V2 2 P1

No.	Species	Cover/abundance Score (see table above)
1	Lepidosperma laterale	2
2	Eucalyptus sideroxylon	5
3	Corymbia maculata	4
4	Entolasia marginata	3
5	Imperata cylindrica var. major	4
6	Brunoniella pumilio	2
7	Adenostemma lavenia	3
8	Eclipta platyglossa	2
9	Lomandra hystrix	3
10	Allocasuarina torulosa	3
11	Eucalyptus globoidea	3
12	Hibbertia dentata	1
13	Bidens pilosa	2
14	Dichelachne micrantha	3
15	Hibbertia aspera	1
16	Breynia oblongifolia	1
17	Persoonia stradbrokensis	1
18	Desmodium rhytidophyllum	2
19	Polyscias sambucifolia	2
20	Dianella caerulea	2
21	Lissanthe strigosa	2
22	Dipodium variegatum	2
23	Dampiera stricta	2
24	Platylobium formosum	2
25	Lomandra longifolia	2
26	Hypoxis exilis	2
27	Cheilanthes sieberi	2
28	Panicum simile	3
29	Echinopogon ovatus	3
30	Glycine clandestina	2
	Pratia purpurascens	2
	Desmodium varians	2

Total species	35
Total native species	35
Total exotic species	
% perennial native understorey cover*	75

* Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons

Themeda triandra 2
Hardenbergia violacea 2
Corymbia intermedia 3

VZ2

Site value:
Transect plot data sheet

(Start a new sheet for each vegetation zone)

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Northern Ri		T. Pepper	01/12

Proposal ID	Proposal name	Zone ID
VZ2	Sancrox Quarry	VZ2

Vegetation formation Dry Sclerophyll Forests

Vegetation class Hunter-Macleay Dry Sclerophyll

Vegetation type PMVC_35 Spotted Gum Grassy Dry Forest

Condition (low or mod/good)	**Zone descriptor** (optional)	**Geographic/habitat features** (tick after printing step 2 of Credit Calculator)
Mod-good	Good	☐

Coordinates (GPS datum GDA94:_____)

Transect / plot number	P1	P2	P3	4	5	6	7	8	9	10
Easting										
Northing										
Zone AMG										

Transect 10 points along 50-m transect (see transect tally table for % foliage cover variables)

Native over-storey cover (%)	25.5	28	18							
Native mid-storey cover (%)	5.5	6.5	3.5							
Native ground cover (grasses) (%)	70	84	68							
Native ground cover (shrubs) (%)	2	4	4							
Native ground cover (other) (%)	48	52	32							
Exotic plant cover	0	0	0							

Larger sampling area

Native plant species richness [1]	35	32	35							
Number of trees with hollows [2]	0	0	0							
Over-storey regeneration [3]	1.0	0.5	0.5							
Total length of fallen logs (m) [2]	78	64	112							

Comments/additional conservation values (riparian areas, special features, geology, etc.):

[1] 20 x 20 m plot [2] 20 x 50 m plot [3] whole zone

VZ2P1

[Tallied] JP 01/12

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank **Proposal ID:** VZ2P1 **Date:** 30/11 **Recorder(s):** A. Pepper

Vegetation type: Spotted Gum **AMG Zone** 56 **Easting/Northing:** -31.43471 / +152.81526 **Photos:**

Native over-storey species list At 10 points along the 50-m transect	Regen-eration (√) (zone)	Native mid-storey species list (>1m to <over-storey) At 10 points along the 50-m transect	Native ground cover (grasses) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (shrubs) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (other) species list (ground stratum <1m) At 50 points along the 50-m transect	Exotic plants species list At 50 points along the 50-m transect	Fallen logs (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
5 30		30	2		2		9
10 5		0	3		3		1.5
15 30		0	1		1		25
20 25		25	5		5		1.3
25 40		0	5		2		6
30 35		0	4		3		3.5
35 25		0	5		2		7
40 20		0	2		1		1.0
45 25		0	4	1	4		1.0
50 20		6	4		1		1.5
255							1.0
	1.0	55					8.5
Total number of species =							
Foliage cover (%) =							
Benchmark value (%FC) =							
Average crown diameter =							
Average foliage cover (%) = 25.5							
Number of trees =							
Sample area = 20x50							
Whole zone							
Number of trees with hollows = 0							
Sample area = 20x50		Total no of species = 55	Total no of species = 35	Total no of species = 1	Total no of species = 24	Total no of species = 0	Total (m) = 78
Benchmark value =		Foliage cover (%) = 5.5	Foliage cover (%) = 70	Foliage cover (%) = 2	Foliage cover (%) = 48	Foliage cover (%) = 0	Benchmark (m) =

SITE AND OTHER NOTES:

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

bearing 295° slope - 7.5°

VZ2P2

[Rolled] 30 01/12

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank **Proposal ID:** VZ2P2 **Date:** 30.11.15 **Recorder(s):** J. Pepper

Vegetation type: Spotted Gum **AMG Zone** 56 **Easting/Northing:** -31.43585° / +152.81419 **Photos:**

Native over-storey species list At 10 points along the 50-m transect	Regen-eration (√) (zone)	Native mid-storey species list (>1m to <over-storey) At 10 points along the 50-m transect	Native ground cover (grasses) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (shrubs) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (other) species list (ground stratum <1m) At 50 points along the 50-m transect	Exotic plants species list At 50 points along the 50-m transect	Fallen logs (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
0 25		20	1 5 / 1 6	1	1 / 1		25
5 10		30	1 / 1 6		1 / 1		6
10 30		0	1 / 1 5		1 /		0
15 35		0	1 / 1 5 / 1 / 1 6		1 /		3
20 50		0	1 / 1 6 / 1 / 5		1 / 1		3.5
25 55		6	1 / 1		1 / 1		4
30 50		0	1 / 1				3
35 60		0	1 / 1				1.5
40 0		35	1 / 1		1 / 1		12
45 6		0	1 / 1				
50			1 / 1		1 /		
280	0.5	65	1 / 1	1	1		
Total number of species =			1 / 1		1		
Foliage cover (%) =			1 / 1		1		
Benchmark value (%FC) =			1 / 1		1 / 1		
Average crown diameter =			1 / 1		1 / 1		
Average foliage cover (%) = 28.0			1 / 1		1 / 1		
Number of trees =			1 / 1		1 / 1		
Sample area = 20 x 50 = 1000 m²			1 / 1		1 / 1		
Whole zone			1 / 1		1 / 1		
Number of trees with hollows = 0			1 / 1		1 / 1		
Sample area = 20x50m			1 / 1		1 / 1		
Benchmark value =			1 / 1 1 1 1		1 / 1		
		Total no of species = 65	Total no of species = 42	Total no of species = 2	Total no of species = 26	Total no of species = 0	Total (m) = 64
		Foliage cover (%) = 6.5	Foliage cover (%) = 84	Foliage cover (%) = 4	Foliage cover (%) = 52	Foliage cover (%) = 0	Benchmark (m) =

SITE AND OTHER NOTES:

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

Slope 7° bearing 304°

VZ2P3

Transect plot worksheet

[Tallied] OP 01/12

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank **Proposal ID:** VZ2P3 **Date:** 01/12 **Recorder(s):** J. Pepper

Vegetation type: Spotted Gum **AMG Zone** 56 **Easting/Northing:** -31.43849/+150.81654 **Photos:**

Native over-storey species list At 10 points along the 50-m transect		Regen-eration (√) (zone)	**Native mid-storey species list** (>1m to <over-storey) At 10 points along the 50-m transect	**Native ground cover (grasses) species list** (ground stratum <1m) At 50 points along the 50-m transect		**Native ground cover (shrubs) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (other) species list** (ground stratum <1m) At 50 points along the 50-m transect		**Exotic plants species list** At 50 points along the 50-m transect	**Fallen logs** (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
5	10		1 6	1 1 1 1	4	1	1 1	2		3.
10	30		0	1 1 1 1 1	5					15
15	10		0	1 1 1 1	4	1				1.0
20	25		0	1 1 1 1 1	5		1 1	2		10.0
25	25		0	1 1 1	3		1 1	2		4,5
30	5		0				1 1	2		3.5
35	5		0	1 1 1	3		1 1	2		3.0
40	20		35	1 1 1 1	4		1 1 1	3		10.0
45	25		0	1 1 1 1	4		1	1		10.0
50	25		0	1 1	2		1 1	2		14.0
	180	0.5								18.0
										5.0
										5.0
										4.0
										1.0
										4.0

Total number of species =
Foliage cover (%) =
Benchmark value (%FC) =
Average crown diameter =
Average foliage cover (%) = 18%
Number of trees =
Sample area = 20 x 50

Whole zone
Number of trees with hollows = 0
Sample area = 20x50
Benchmark value =

Total no of species = 35	Total no of species = 34	Total no of species = 2	Total no of species = 16	Total no of species = 0	Total (m) = 112
Foliage cover (%) = 3.5	Foliage cover (%) = 68	Foliage cover (%) = 4	Foliage cover (%) = 22	Foliage cover (%) = 0	Benchmark (m) =

SITE AND OTHER NOTES:

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

bearing 350° slope + 5°

Site value:
Transect tally table

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Northern R		T. Peppe	01/12

Proposal ID	Proposal name	Zone ID
VZ2	Sancrox Quarry	VZ2

Vegetation formation Dry Sclerophyll Forests

Vegetation class Hunter_Macleay Dry Sclerophyll

Vegetation type PMVC_35 Spotted Gum Grassy Dry Forest

Condition (low or mod/good)	**Zone descriptor** (optional)	**Geographic/habitat features** (tick after printing step 2 of Credit Calculator)
Mod-good	Good	☐

Transect number VZ2 P1	Number of hits (tally)	%
Native over-storey cover (%)	255	25.5
Native mid-storey cover (%)	55	5.5
Native ground cover (grasses) (%)	35	70
Native ground cover (shrubs) (%)	1	2
Native ground cover (other) (%)	24	48
Exotic plant cover (%)	0	0

Transect number VZ2 P2	Number of hits (tally)	%
Native over-storey cover (%)	280	28
Native mid-storey cover (%)	65	6.5
Native ground cover (grasses) (%)	42	84
Native ground cover (shrubs) (%)	2	4
Native ground cover (other) (%)	26	52
Exotic plant cover (%)	0	0

Transect number VZ2 P3	Number of hits (tally)	%
Native over-storey cover (%)	180	18
Native mid-storey cover (%)	35	3.5
Native ground cover (grasses) (%)	34	68
Native ground cover (shrub) (%)	2	4
Native ground cover (other) (%)	16	32
Exotic plant cover (%)	0	0

Transect number_____	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover grasses (%)		
Native ground cover shrubs (%)		
Native ground cover other (%)		
Exotic plant cover (%)		

Floristic datasheet – 20 m X 20 m quadrat

V2 2 P 2

No.	Species	Cover/abundance Score (see table above)
1	Brunon. pumilio	2
2	Imperata cyl. var. maj.	3
3	Adiantum aethiopic.	2
4	Oplismenus imbecil	3
5	Entolasia stricta	2
6	Entolasia marginata	2
7	Oxalis perennans	2
8	Glycine clandestina	2
9	Desmodium rhytidoph.	2
10	Dianella caerulea	2
11	Corymbia maculata	4
12	Allocasuarina torulosa	3
13	Adenostemma lavenia	2
14	Breynia oblongifolia	2
15	Hydrocotyl pedunculara	3
16	Pandorea Pandorana	3
17	Hibbertia aspera	2
18	Echinopogon ovatus	2
19	Hypotis exilis	2
20	* Paspalum urvillei	2
21	Platylobium formosum	2
22	Eucalyptus globoidea	3
23	Acacia floribunda	1
24	* Conyza bonariensis	2
25	Polyscias sambucif.	3
26	Eucalyptus acmenoides	3
27	Pratia purpurascens	2
28	Poa sieberiana	2
29	Hardenbergia violacea	2
30	Lophostemon confertus	3
	Glochid. ferdin. var. ferdin.	1
	Calotis (?) dentex	2

Total species	34
Total native species	32
Total exotic species	2
% perennial native understorey cover*	65

* Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons

Melichrus urceolatus 1
Billardiera scandens 2

Floristic datasheet – 20 m X 20 m quadrat

VZ 3/2P2b

No.	Species	Cover/abundance Score (see table above)
1	Corymbia intermedia	3
2	Allocasuarina torulosa	3
3	Alphitonia excelsa	1
4	Parsonsia straminea	1
5	Rubus moluccanus tril.	3
6	Themeda triandra	3
7	Hibbertia scandens	2
8	Polyscias sambuc.	3
9	Imperata cyl. var. major	4
10	Breynia oblongif.	2
11	Euc. acmenoides	3
12	Euc. propinqua	3
13	Euc. carnea	3
14	Dianella caerulea	3
15	Euc. siderophloia	4
16	Oplismenus aemulus	3
17	Brunoniella pumil.	2
18	Desmodium rhytidophyllum	2
19	Allocas. torulosa	2
20	Entolasia marginata	3
21	Pandorea pandorana	2
22	Pimelea ligustrina	2
23	Desmodium varians	2
24	Hydrocotyle pedicellar	2
25	Geitonopl. cym.	2
26	Eustreph. latif.	2
27	Bidens pilosa	2
28	Paspalum orbiculare	2
29	Cheilanthes sieberi subsp sie	1
30	Glycine clandestina	2
	Adenostemma lavenia	2
	Oplismenus imbecillis	3

Total species	35
Total native species	35
Total exotic species	
% perennial native understorey cover*	85

* Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons

Cassytha glab. 1
Hardenbergia violac. 1
Callistemon salignus 1

Floristic datasheet – 20 m X 20 m quadrat

VZ3P1

No.	Species	Cover/abundance Score (see table above)
1	Centella asiatica	3
2	Carex appressa	3
3	Microlaena stip. var. stip.	4
4	Hydrocotyle peduncularis	3
5	Entolasia marginata	2
6	Oplismenus undulatifolius	2
7	Oxalis perennans	2
8	Echinopogon ovatus	3
9	Oplismenus imbecillis	3
10	Callistemon salignus	4
11	Glochidion ferd. var. ferd.	3
12	Allocasuarina littoralis	4
13	Melaleuca linariifolia	3
14	Viola hederacea	3
15	Eucalyptus globoidea	3
16	Corymbia gummifera	3
17	Alphitonia excelsa	2
18	Pteridium esculentum	2
19	Gahnia clarkei	2
20	Breynia oblongifolia	2
21	Lomandra longifolia	2
22	Hibbertia scandens	3
23	Pittosporum undulatum	2
24	Dichondra repens	3
25	Eucalyptus microcorys	3
26	Billardiera scandens	2
27	Eucalyptus sideroxylon	3
28	Glycine clandestina	2
29	*Cinnamomum camphora	2
30	Lysanthe strigosa	2
	Pandorea pandorana	2
	Imperata cylind. var. major	3

Total species	33
Total native species	32
Total exotic species	1
% perennial native understorey cover*	80

* Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons

Cassytha glabra 2

VZ3P1

[data tallied] JP 01/12

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank **Proposal ID:** VZ3P1 **Date:** 30.11.15 **Recorder(s):** J. Pepper

Vegetation type: White Stringy bark **AMG Zone** 56 **Easting/Northing:** -31.43494 / +152.81037 **Photos:**

Native over-storey species list At 10 points along the 50-m transect		Regen-eration (√) (zone)	Native mid-storey species list (>1m to <over-storey) At 10 points along the 50-m transect	Native ground cover (grasses) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (shrubs) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (other) species list (ground stratum <1m) At 50 points along the 50-m transect	Exotic plants species list At 50 points along the 50-m transect	Fallen logs (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
5	0		35	5		5		8
10	10		5	4	1	5		27
15	30		10	5		4		14
20	35		0	4		4		2.5
25	40		0	4	1	4		4
30	30		0	5	3	4		13
35	20		0	5		3		6
40	25		0	5		5		2.5
45	30		0	4		2		2
50	30		5	5		2		2
	240/10							3
	= 24%	0.25						4
								6
								15

Total number of species = 34
Foliage cover (%) = 24%
Benchmark value (%FC) =
Average crown diameter = -
Average foliage cover (%) = 24%
Number of trees =
Sample area = 20 x 50

Whole zone
Number of trees with hollows = 0
Sample area = 20x50
Benchmark value =

Total no of species = 55	Total no of species = 46	Total no of ~~species~~ hits = 5	Total no of species = 38	Total no of species = 0 / Total (m) = 104
Foliage cover (%) = 5.5	Foliage cover (%) = 92	Foliage cover (%) = 10	Foliage cover (%) = 72	Foliage cover (%) = 0 / Benchmark (m) =

SITE AND OTHER NOTES:

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

Field data sheets for BioBanking : Biobank site proposal package February 2009

bearing 168° slope +5°

VZ3P2

Transect plot worksheet

Flatland JP 01/12

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank **Proposal ID:** VZ3P2 **Date:** 30/11 **Recorder(s):** J Peppe

Vegetation type: White Stringybark **AMG Zone** 56 **Easting/Northing:** -31.43482 / +152.81595 **Photos:**

Native over-storey species list At 10 points along the 50-m transect		Regeneration (√) (zone)	Native mid-storey species list (>1m to <over-storey) At 10 points along the 50-m transect	Native ground cover (grasses) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (shrubs) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (other) species list (ground stratum <1m) At 50 points along the 50-m transect	Exotic plants species list At 50 points along the 50-m transect	Fallen logs (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
5	0		5	5	1	3		14
10	80		70	3	2	2		17
15	40		0	4	1			20
20	50		50	5	2	2		3
25	20		0	4	1	4		9
30	0		0	5		4		23
35	25		35	4		1		91
40	0		50	1		5		
45	0		70	4		3		
50	0		40	5	1	5		
	185							
		1.0						

Total number of species =
Foliage cover (%) = 18.5
Benchmark value (%FC) =
Average crown diameter =
Average foliage cover (%) = 18.5%
Number of trees =
Sample area = 20 x 50

Whole zone
Number of trees with hollows = 1
Sample area = 20x50
Benchmark value =

Total no of species = 32	Total no of species = 40	Total no of species = 8	Total no of species = 29	Total no of species = 0	Total (m) = 81
Foliage cover (%) = 32%	Foliage cover (%) = 80	Foliage cover (%) = 16	Foliage cover (%) = 58	Foliage cover (%) = 0	Benchmark (m) =

SITE AND OTHER NOTES:

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

bearing 20° Slope -12°

VZ3P3

[tallied 30/11]

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank **Proposal ID:** VZ3P3 **Date:** 30/11 **Recorder(s):** J. Pepper

Vegetation type: White Stringybark **AMG Zone** 56 **Easting/Northing:** -31.43793 / +152.81008 **Photos:**

Native over-storey species list At 10 points along the 50-m transect		Regen-eration (√) (zone)	Native mid-storey species list (>1m to <over-storey) At 10 points along the 50-m transect	Native ground cover (grasses) species list (ground stratum <1m) At 50 points along the 50-m transect		Native ground cover (shrubs) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (other) species list (ground stratum <1m) At 50 points along the 50-m transect		Exotic plants species list At 50 points along the 50-m transect	Fallen logs (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
5	30		0	1	1		1	1		1.5
10	0		0	1 1 1 1	4		1 1	2		3.5
15	25		0	1 1 1 1 1	5		1 1 1 1 1	5		0.5
20	25		0	1 1 1 1 1	5		1 1 1 1 1	5		11
25	50		0	1 1 1 1	4		1 1 1	3		5
30	30		0	1 1 1 1 1	5	1	1 1	2		1
35	10		20	1 1 1 1 1	5	1	1	1		13
40	25		0	1 1 1	3		1 1 1	3		3
45	10		0	1 1 1 1 1	5		1 1 1	3		3
50	0		0	1 1 1	3		1	1		3
										3.5
		0.5								10
										3
										6
										8.5
										5
										8
										1
										10
Total number of species =										
Foliage cover (%) =										
Benchmark value (%FC) =										
Average crown diameter =										
Average foliage cover (%) =										
Number of trees =										
Sample area = 20x50										
Whole zone										
Number of trees with hollows = 1.0										
Sample area = 20x50										
Benchmark value =			Total no of species =	Total no of species = 40		Total no of species = 2	Total no of species = 26		Total no of species = 0	Total (m) = 98.5
			Foliage cover (%) =	Foliage cover (%) = 80%		Foliage cover (%) = 4	Foliage cover (%) = 52		Foliage cover (%) = 6	Benchmark (m) =

SITE AND OTHER NOTES:

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

bearing 187° Slope + 3°

VZ3P4

[tallied] TP 01/12

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank **Proposal ID:** VZ3P4 **Date:** 01/12 **Recorder(s):** J. Pepper

Vegetation type: White Stringybark **AMG Zone** 56 **Easting/Northing:** -31.43889 / +152.81824 **Photos:**

Native over-storey species list At 10 points along the 50-m transect		Regen-eration (√) (zone)	Native mid-storey species list (>1m to <over-storey) At 10 points along the 50-m transect	Native ground cover (grasses) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (shrubs) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (other) species list (ground stratum <1m) At 50 points along the 50-m transect	Exotic plants species list At 50 points along the 50-m transect	Fallen logs (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
5	40		0	5		3		3.0
10	30		30	5				10.6
15	10		50	3		3		5.0
20	10		5	3		5		
25	50		10			3		5.0
30	30		40	3		3		
35	40		30	5		1		
40	30		50	5		3		
45	10		0			2		
50	60		50	1		3		
	310	1.0						

Total number of species = 30
Foliage cover (%) =
Benchmark value (%FC) =
Average crown diameter =
Average foliage cover (%) = 31%
Number of trees =
Sample area = 20x50

Whole zone
Number of trees with hollows = 0
Sample area = 20x50
Benchmark value =

Total no of species = 265	Total no of species = 30	Total no of species = 0	Total no of species = 26	Total no of species = 0	Total (m) = 23
Foliage cover (%) = 26.5	Foliage cover (%) = 60	Foliage cover (%) = 0	Foliage cover (%) = 52	Foliage cover (%) = 0	Benchmark (m) =

SITE AND OTHER NOTES:

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

bearing 136° slope − 3°

added rule 0cm ... 10cm VZ3P5

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank **Proposal ID:** VZ3P2 **Date:** 30/11/15 **Recorder(s):** J Pepper

Vegetation type: White Stringybark/Tall **AMG Zone** 56 **Easting/Northing:** -31.43566 / +152.81531 **Photos:**

Native over-storey species list At 10 points along the 50-m transect	Regen-eration (√) (zone)	**Native mid-storey species list** (>1m to <over-storey) At 10 points along the 50-m transect	**Native ground cover (grasses) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (shrubs) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (other) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Exotic plants species list** At 50 points along the 50-m transect	**Fallen logs** (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
5 · 40		25	//// 4		/// 3		16
10 · 5		50	/ 1		// 2		25
15 · 30		0	/// 3		//// 5		4
20 · 60		0	//// 4		/// 3		11
25 · 20		0	//// 4		// 2		13
30 · 10		0	//// 4	/	//// 4		12
35 · 70		0	///// 5		// 2		4
40 · 50		0	//// 4		/ 1		4
45 · 50		0	///// 5	/			6
50 · 30		0	///// 5				3
365							
	1.0						

Total number of species =
Foliage cover (%) = 36.5
Benchmark value (%FC) =
Average crown diameter =
Average foliage cover (%) = 36.5
Number of trees =
Sample area = 20x50 m

Whole zone
Number of trees with hollows = 0
Sample area = 20x50m
Benchmark value =

Total no of species = 35	Total no of species = 39	Total no of species = 2	Total no of species = 22	Total no of species = 0	Total (m) = 91
Foliage cover (%) = 7.5	Foliage cover (%) = 28	Foliage cover (%) = 4	Foliage cover (%) = 44	Foliage cover (%) = 0	Benchmark (m) =

SITE AND OTHER NOTES:

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

slope 6° down 18° bearing

Site value:
Transect tally table

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Northern Rivers		J. Pepper	30. 11. 15

Proposal ID	Proposal name	Zone ID
VZ3	Sancrox Quarry	VZ3

Vegetation formation: Dry Sclerophyll Forest (Grassy)

Vegetation class: Hunter Macleay Dry Sclerophyll Forest s

Vegetation type: White Stringybark

Condition (low or mod/good)	Zone descriptor (optional)	Geographic/habitat features (tick after printing step 2 of Credit Calculator)
Mod- good	good	☐

Transect number VZ3P3	Number of hits (tally)	%
Native over-storey cover (%)	(30+25+25+50+30+10+25+10)	20.5
Native mid-storey cover (%)	20%	2
Native ground cover (grasses) (%)	1+4+5.1 5+4+5+3+5+3	80
Native ground cover (shrubs) (%)	2	4
Native ground cover (other) (%)	1+2+5+5+3+2+1+3+3.1	52
Exotic plant cover (%)	0	0

Transect number VZ3 P5	Number of hits (tally)	%
Native over-storey cover (%)	40+5+30+60+20+10+70+50+50+30	365
Native mid-storey cover (%)	(25+50)/10	7.5
Native ground cover (grasses) (%)	39	78
Native ground cover (shrubs) (%)	2	4
Native ground cover (other) (%)	22	44
Exotic plant cover (%)	0	0

Transect number VZ3P1	Number of hits (tally)	%
Native over-storey cover (%)	240/10	24
Native mid-storey cover (%)	55/10	5.5
Native ground cover (grasses) (%)	46	92
Native ground cover (shrub) (%)	5	10
Native ground cover (other) (%)	38	72
Exotic plant cover (%)	0	0

Transect number VZ3P2	Number of hits (tally)	%
Native over-storey cover (%)	185	18.5
Native mid-storey cover (%)	320	32
Native ground cover grasses (%)	40	80
Native ground cover shrubs (%)	8	16
Native ground cover other (%)	29	58
Exotic plant cover (%)	0	0

Transect number VZ3P4	Number of hits (tally)	%
Native over-storey cover (%)	310	31
Native mid-storey cover (%)	265	265
Native ground cover (grasses) (%)	30	60
Native ground cover (shrubs) (%)	0	0
Native ground cover (other) (%)	26	52
Exotic plant cover (%)	0	0

Transect number______________	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrubs) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number______________	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrubs) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number______________	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrubs) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number______________	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrubs) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

Transect number______________	Number of hits (tally)	%
Native over-storey cover (%)		
Native mid-storey cover (%)		
Native ground cover (grasses) (%)		
Native ground cover (shrubs) (%)		
Native ground cover (other) (%)		
Exotic plant cover (%)		

VZ3

Site value:
Transect plot data sheet

(Start a new sheet for each vegetation zone)

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Northern Rivers		J. Pepper	30.11.15

Proposal ID	Proposal name	Zone ID
	Sancrox Quarry	VZ3

Vegetation formation: Dry Sclerophyll Forest (Grassy)

Vegetation class: Hunter-Macleay Dry Sclerophyll Forests

Vegetation type: White Stringybark

Condition (low or mod/good)	Zone descriptor (optional)	Geographic/habitat features (tick after printing step 2 of Credit Calculator)
Mod-good	good	☐

Coordinates (GPS datum GDA94:_____)

Transect / plot number	1 P3	2 P5	3 P1	4 P2	5 P4	6	7	8	9	10
Easting										
Northing										
Zone AMG	56	56	56	56	56					

Transect 10 points along 50-m transect (see transect tally table for % foliage cover variables)

Native over-storey cover (%)	20.5	36.5	24	18.5	31					
Native mid-storey cover (%)	2	7.5	5.5	32	26.5					
Native ground cover (grasses) (%)	80	78	92	80	60					
Native ground cover (shrubs) (%)	4	4	10	16	0					
Native ground cover (other) (%)	52	44	72	58	52					
Exotic plant cover	0	0	0	0	0					

Larger sampling area

Copy →

Native plant species richness [1]	30	35	32	33	29					
Number of trees with hollows [2]	1	0	1	1	6					
Over-storey regeneration [3]	0.5	1.0	0.25	1.0	1.0					
Total length of fallen logs (m) [2]	98.5	97	104	81	23					

Comments/additional conservation values (riparian areas, special features, geology, etc.):

[1] 20 x 20 m plot [2] 20 x 50 m plot [3] whole zone

Site value:
Transect tally table

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Northern Rivers		J. Pepper	30. 11. 15

Proposal ID	Proposal name	Zone ID
VZ3	Sancrox Quarry	VZ3

Vegetation formation Dry Sclerophyll Forest (Grassy

Vegetation class Hunter Macleay Dry Sclerophyll Forest s

Vegetation type White Stringybark

Condition (low or mod/good)	Zone descriptor (optional)	Geographic/habitat features (tick after printing step 2 of Credit Calculator)
Mod- good	good	☐

Transect number VZ3P3	Number of hits (tally)	%
Native over-storey cover (%)	(30+25+25+50+30+10+25+10)	20.5
Native mid-storey cover (%)	20%	2
Native ground cover (grasses) (%)	1+4+5+5+4+5+5+2+5+3	80
Native ground cover (shrubs) (%)	2	4
Native ground cover (other) (%)	1+2+5+5+3+2+1+3+3+1	52
Exotic plant cover (%)	0	0

Transect number VZ3 P5	Number of hits (tally)	%
Native over-storey cover (%)	40+5+30+60+20+10+70+50+50+30	365
Native mid-storey cover (%)	(25+50)/10	7.5
Native ground cover (grasses) (%)	39	78
Native ground cover (shrubs) (%)	2	4
Native ground cover (other) (%)	22	44
Exotic plant cover (%)	0	0

Transect number VZ3P1	Number of hits (tally)	%
Native over-storey cover (%)	240/10	24
Native mid-storey cover (%)	55/10	5.5
Native ground cover (grasses) (%)	46	92
Native ground cover (shrub) (%)	5	10
Native ground cover (other) (%)	38	72
Exotic plant cover (%)	0	0

Transect number VZ3P2	Number of hits (tally)	%
Native over-storey cover (%)	185	18.5
Native mid-storey cover (%)	320	32
Native ground cover grasses (%)	40	80
Native ground cover shrubs (%)	8	16
Native ground cover other (%)	29	58
Exotic plant cover (%)	0	0

Floristic datasheet – 20 m X 20 m quadrat

V23P2

No.	Species	Cover/abundance Score (see table above)
1	Veronica calycina	3
2	Echinopogon ovatus	2
3	Dichondra repens	3
4	Lomandra hystrix	2
5	Melichrus urceol.	2
6	Pandorea pandorana	2
7	Imperata cylindrica v. m.	4
8	Desmodium rhytidop.	2
9	Oxalis perennans	2
10	Hardenbergia violacea	2
11	Pratia purpurascens	2
12	Lomandra longifolia	3
13	Adenostemma [illegible]	2
14	Dianella caerulea	2
15	Capparis clematidea	2
16	Glycine clandestina	2
17	Calotis (?) dentex	2
18	Brunoniella pumilio	2
19	Allocasuarina torulosa	3
20	Euca. sideroph.	4
21	Entolasia marginata	3
22	Oplismenus aemulus	3
23	Eustrephus latifolius	2
24	Geitonoplesium cymosum	2
25	Desmodium varians	3
26	Euca. propinqua	3
27	Themeda triandra	2
28	Cassinia (?) uncata	2
29	Euca. acmenoides	4
30	* Lantana camara	1
	Allocas. littoralis	2
	Polyscias sambucif.	2

Total species	34
Total native species	1
Total exotic species	33
% perennial native understorey cover*	75

* Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons

Rytidosperma (?) longifolium 2
Aphanopetalum resinosum 1

Floristic datasheet – 20 m X 20 m quadrat

V23 P3

No.	Species	Cover/abundance Score (see table above)
1	Alphitonia excelsa	2
2	Euca. miaroc.	3
3	Eucca. acmenoid.	4
4	Euca. globoidea	4
5	Centella asiatica	3
6	Micrel. styp. var. styp.	3
7	Cyperus umbrecilla	3
8	Lomandra longifolia	3
9	Imperata cylind. v. maj.	3
10	Euca. propinqua	4
11	Sonnantha gimilis	2
12	Paspalum orbiculan	2
13	Oxalis perennan	2
14	Poreysia oblongifolia	2
15	Oplismenus aemulus	3
16	Melaleuca linariifolia	3
17	Acacia floribunda	3
18	Melichrus urceolatus	2
19	Echinopogon ovatus	2
20	Oplismenus imbecillis.	2
21	Glochidion ferd. var ferd.	2
22	Entolasia marginata	2
23	Hibbertia scandens	2
24	Brunoniella pumilu	2
25	Hydrocotyle pedunculat.	2
26	Cheilanthes sieberi ssp sieb.	2
27	Adenostemma lav.	2
28	Panicum simile	2
29	Entolasia stricta	2
30	Arthropodium minus	2

Total species	30
Total native species	30
Total exotic species	
% perennial native understorey cover*	85

* Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons

Floristic datasheet – 20 m X 20 m quadrat

V23 P4

No.	Species	Cover/abundance Score (see table above)
1	* Solanum mauritianum	2
2	* Lantana camara	3
3	* Paspalum urvillei	2
4	* Passiflora edulis	1
5	Solanum (?) prinophyllum	2
6	Euca. microcorys	4
7	Allocas. torulosa	3
8	Rubus molucc. trilo.	2
9	Calochlaena dubia	3
10	Acacia floribunda	2
11	Gahnia clarkei	2
12	Parsonsia straminea	2
13	Persoonia stradbrokensis	2
14	Desmodium varians	2
15	Microlaena stipoides v. stip.	3
16	Oplismenus imbecillis	3
17	Adenostem. lav.	2
18	Pratia purpurascens	2 2
19	Hydrocotyle peduncularis	2 2
20	Lepidosperma laterale	2
21	Poa sieberiana	3
22	Echinopogon ovatus	2
23	Entolasia marginata	3
24	Desmodium rhytidophyl.	2
25	Euca. siderophloia	3
26	Corymbia intermedia	4
27	Lomandra longifolia	2
28	Platylobium formosum	2
29	Euca. globoidea	3
30	Cordyline stricta	2
	Brunoniella pumilio	2

Lomandra hystrix 2

Total species	33
Total native species	4
Total exotic species	29
% perennial native understorey cover*	75

* Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons

Imperata cylind. v. maj. 2

JY / VY

Floristic datasheet – 20 m X 20 m quadrat

VZ ~~32~~ P2b

No.	Species	Cover/abundance Score (see table above)
1	Corymbia intermedia	3
2	Allocasuarina torulosa	3
3	Alphitonia excelsa	1
4	Parsonsia straminea	1
5	Rubus moluccanus tril.	3
6	Themeda triandra	3
7	Hibbertia scandens	2
8	Polyscias sambuc.	3
9	Imperata cyl. var. major	4
10	Breynia oblongif.	2
11	Euc. acmenoides	3
12	Euc. propinqua	3
13	Euc. carnea	3
14	Dianella caerulea	3
15	Euc. siderophloia	4
16	Oplismenus aemulus	3
17	Brunoniella pumil.	2
18	Desmodium rhytidophyllum	2
19	Allocas. torulosa	2
20	Entolasia marginata	3
21	Pandorea pandorana	2
22	Pimelea ligustrina	2
23	Desmodium varians	2
24	Hydrocotyle pedicellaris	2
25	Geitonopl. cym.	2
26	Eustrephus latif.	2
27	Bidens pilosa	2
28	Paspalum orbiculare	2
29	Cheilanthes sieberi subsp sie	1
30	Glycine clandestina	2
	Adenostemma lavenia	2
	Oplismenus imbecillis	3

Total species	35
Total native species	35
Total exotic species	
% perennial native understorey cover*	85

* Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons

Cassytha glab.	1
Hardenbergia violac.	1
Callistemon salignus	1

Floristic datasheet – 20 m X 20 m quadrat

V2 4 (old quarry)

No.	Species	Cover/abundance Score (see table above)
1	*Andropogon virginicus	4
2	Euca. globoidea	3
3	Euca. carnea	3
4	Entdasia stricta	2
5	Platylobium formosum	2
6	Hardenbergia violacea	2
7	Daviesia ulicifolia	2
8	Dodonaea viscosa	1
9	Calotis (?) lappulacea	2
10	Melichrus urceolatus	2
11	Dianella caerulea	2
12	Desmodium rhytidophyllum	2
13	Entolasia marginata	2
14	*Gomphocarpus pinnatum	1
15	Eucalyptus propinqua	1
16	*Cyperus eragrostis	2
17	Cyperus umbellifer	2
18	Juncus usitatus	3
19	Schoenus apogon	2
20	Allocasuarina littoralis	2
21	Echinopogon ovatus	2
22	Phyllanthus lanuginosus	2
23	*Paspalum urvillei	3
24	Cassinia (?) uncata	1
25		
26		
27		
28		
29		
30		

Total species	24
Total native species	21
Total exotic species	3
% perennial native understorey cover*	15

* Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank **Proposal ID:** V2 4 **Date:** 1/12/15 **Recorder(s):** G. L.

Vegetation type: Quarry - regen **AMG Zone** _____ **Easting/Northing:** _____ **Photos:** _____

Native over-storey species list At 10 points along the 50-m transect	Regen-eration (√) (zone)	**Native mid-storey species list** (>1m to <over-storey) At 10 points along the 50-m transect	**Native ground cover (grasses) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (shrubs) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Native ground cover (other) species list** (ground stratum <1m) At 50 points along the 50-m transect	**Exotic plants species list** At 50 points along the 50-m transect	**Fallen logs** (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
5 15		10	II 2	0	I I	I 1	
10 10		5	IIII 4	0	0	II 2	
15 5		0	~~IIII~~ 5	I 1	I 1	~~IIII~~ 5	
20 0		0	II 2	0	II 2	~~IIII~~ 5	
25 0		10	IIII 4	0	I 1	II 2	
30 10		10	III 3	I 1	0	III 3	
35 0		0	II 2	0	I 1	0	
40 0		0	IIII 4	II 2	III 3	I 1	
45 5		0	III 3	0	I 1	I 1	
50 10		0	II 2	0	I 1	III 3	1.5
55	2.0						

Total number of species =							
Foliage cover (%) =							
Benchmark value (%FC) =							
Average crown diameter =							
Average foliage cover (%) = 5.5							
Number of trees =							
Sample area = 20x50							
Whole zone							
Number of trees with hollows = 0							
Sample area =							
Benchmark value =		Total no of species = 21	Total no of species =	Total no of species =	Total no of species =	Total no of species = 23	Total (m) = 1.5
		Foliage cover (%) = 3.5	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Benchmark (m) =

SITE AND OTHER NOTES:

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

old quarry

VZ 4

Site value:
Transect plot data sheet

(Start a new sheet for each vegetation zone)

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Northern Ri.		C. Leonard	01/12

Proposal ID	Proposal name	Zone ID
VZ 4	Sancrox Quarry	VZ 4

Vegetation formation: Dry Sclerophyll Forests (Shrub/grass)

Vegetation class: Hunter-Macleay Dry Sclerophyll Forests

Vegetation type: White Stringybark - Tallowwood - Grey Gum

Condition (low or mod/good)	**Zone descriptor** (optional)	**Geographic/habitat features** (tick after printing step 2 of Credit Calculator)
Low		☐

Coordinates (GPS datum GDA94:)

Transect / plot number	P1	2	3	4	5	6	7	8	9	10
Easting										
Northing										
Zone AMG										

Transect 10 points along 50-m transect (see transect tally table for % foliage cover variables)

Native over-storey cover (%)	5.5									
Native mid-storey cover (%)	3.5									
Native ground cover (grasses) (%)	62									
Native ground cover (shrubs) (%)	8									
Native ground cover (other) (%)	22									
Exotic plant cover	46									

Larger sampling area

Native plant species richness [1]	21									
Number of trees with hollows [2]	0									
Over-storey regeneration [3]	0.7									
Total length of fallen logs (m) [2]	1.5									

Comments/additional conservation values (riparian areas, special features, geology, etc.):

[1] 20 x 20 m plot [2] 20 x 50 m plot [3] whole zone

Floristic datasheet – 20 m X 20 m quadrat

V25 (near office)

No.	Species	Cover/abundance Score (see table above)
1	Dodonaea triquetra	2
2	Corymbia maculata	5
3	Lophostemon confertus	3
4	Daviesia ulicifolia	2
5	Ozothamnus diosmif.	2
6	Euca. pilularis	3
7	Acacia floribunda	3
8	* Paspalum urvillei	2
9	* Gomphocarpus fruti.	2
10	Dianella caerulea	2
11	Pteridium esculentum	2
12	Platylobium formosum	2
13	Entolasia stricta	3
14	Imperata cylind. v major	3
15	Bidens pilosa	2
16	Euca. siderophloia	3
17	Euca. microcorys	3
18	Hardenbergia violacea	2
19	Brunoniella pumilo	2
20	Glycine clandestina	2
21	* Conyza bonariensis	2
22	* Hypochaeris radicata	2
23	Dichondra repens	2
24	Lomandra longifolia	2
25	Microlaena stip. var. stip.	2
26		
27		
28		
29		
30		

Total species	25
Total native species	21
Total exotic species	4
% perennial native understorey cover*	20

* Perennial understorey vegetation cover includes vascular plant species of the ground and shrub layers with a lifecycle of more than two growing seasons

VZ 5

Site value:
Transect plot data sheet

(Start a new sheet for each vegetation zone)

BioBanking
Biodiversity Banking and Offsets Scheme

CMA area	CMA subregion	Recorder	Date
Northern Ri.		J. Pepper	01/12

Proposal ID	Proposal name	Zone ID
VZ 5	Sancrox Quarry	VZ 5

Vegetation formation Dry Sclerophyll Forests

Vegetation class Hunter - Macleay Dry Sclerophyll

Vegetation type PMVC_35 Spotted Gum Grassy Dry Forest

Condition (low or mod/good)	**Zone descriptor** (optional)	**Geographic/habitat features** (tick after printing step 2 of Credit Calculator)
Low		☐

Coordinates (GPS datum GDA94:_____)

Transect / plot number	P1	2	3	4	5	6	7	8	9	10
Easting										
Northing										
Zone AMG										

Transect 10 points along 50-m transect (see transect tally table for % foliage cover variables)

Native over-storey cover (%)	13.5									
Native mid-storey cover (%)	3									
Native ground cover (grasses) (%)	46									
Native ground cover (shrubs) (%)	20									
Native ground cover (other) (%)	26									
Exotic plant cover	20									

Larger sampling area

Native plant species richness [1]	21									
Number of trees with hollows [2]	0									
Over-storey regeneration [3]	1.0									
Total length of fallen logs (m) [2]	36									

Comments/additional conservation values (riparian areas, special features, geology, etc.):

[1] 20 x 20 m plot [2] 20 x 50 m plot [3] whole zone

Transect plot worksheet

Full species IDs are not required for BioBanking, but may be useful for identification of correct vegetation type and for monitoring and audit purposes.

BioBanking
Biodiversity Banking and Offsets Scheme

Site type: Development / BioBank Proposal ID: V25 Date: 1/12/15 Recorder(s): GC

Vegetation type: Patch near office AMG Zone ____ Easting/Northing: ____ Photos: ____

Native over-storey species list At 10 points along the 50-m transect	Regeneration (√) (zone)	Native mid-storey species list (>1m to <over-storey) At 10 points along the 50-m transect	Native ground cover (grasses) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (shrubs) species list (ground stratum <1m) At 50 points along the 50-m transect	Native ground cover (other) species list (ground stratum <1m) At 50 points along the 50-m transect	Exotic plants species list At 50 points along the 50-m transect	Fallen logs (min. 10 cm diameter x 50 cm long) (20 x 50m plot)
5 35		5	11 2	1 1	0	1 1	
10 35		5	11 2	1 1	0	11 2	
15 10		0	1 1	0	11 2	11 2	2.5
20 0		5	0	1 1	11 2	111 3	
25 0		5	11 2	111 3	1 0	1 1	1.0
30 20		5	0	1 1		1 1	
35 30		0	1111 4	11 2	0	0 0	>30m
40 5		0	1111 4	0	11 2	0 0	
45 0		0	1111 4	1 1	111 3	0 0	
50 0		5	1111 4	0	111 3	0 0	
135	3.0						
Total number of species =							
Foliage cover (%) =							
Benchmark value (%FC) =							
Average crown diameter =							
Average foliage cover (%) = 13.5							
Number of trees =							
Sample area =							
Whole zone							
Number of trees with hollows =							
Sample area =							>33.5
Benchmark value =		Total no of species = 21	Total no of species =	Total no of species =	Total no of species =	Total no of species =	Total (m) =
		Foliage cover (%) = 3.0	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Foliage cover (%) =	Benchmark (m) =

SITE AND OTHER NOTES:

NB: Transects / plots should be placed randomly with the minimum number required for the zone in accordance with Table 4 of the Operational Manual.

APPENDIX D

Greater Sancrox Structure Plan Area (Map)

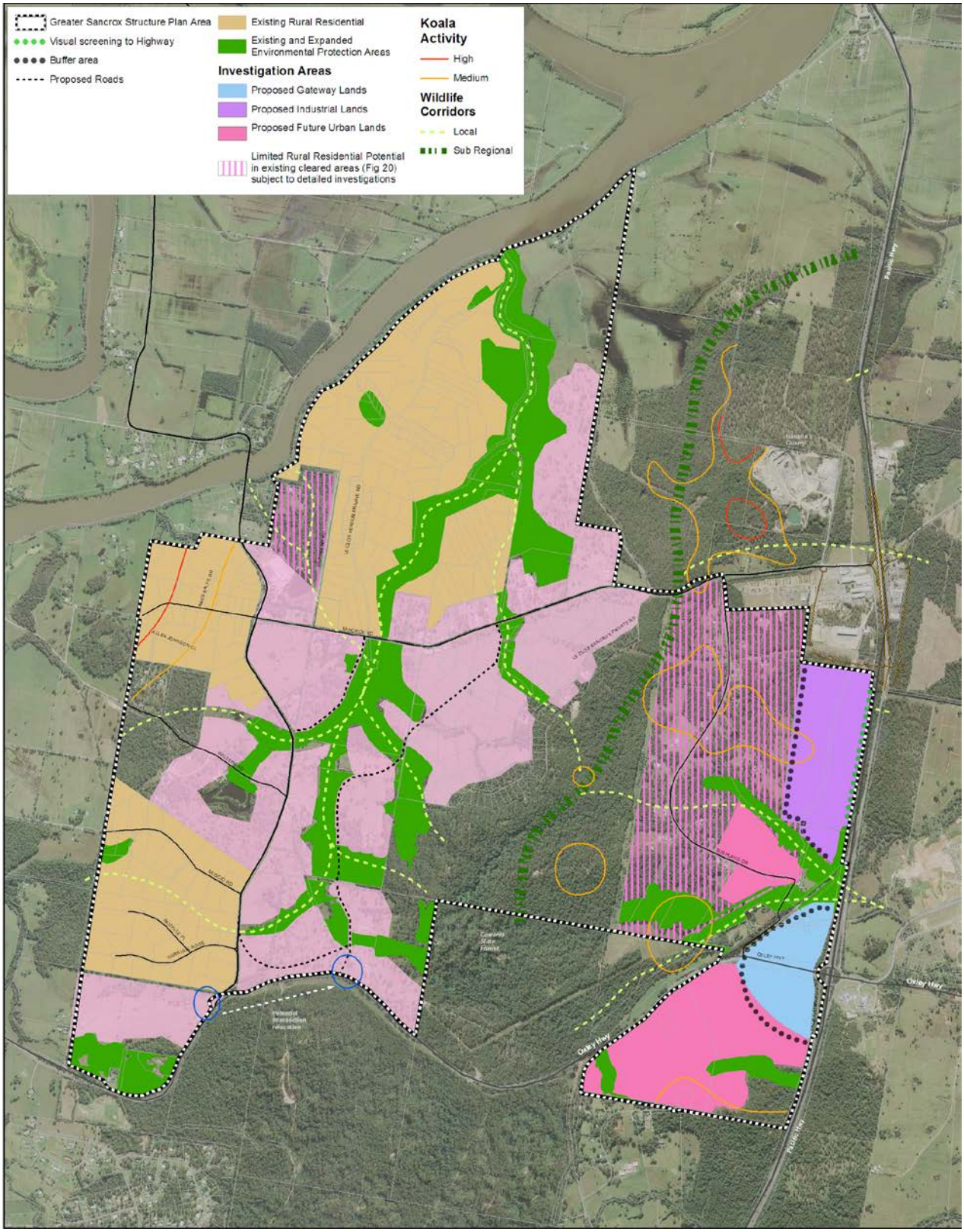


Figure 19 - Structure Plan map

APPENDIX E

Council BVT Profiles

PMVC_035. Spotted Gum Grassy Dry Forest

Formation	Dry Sclerophyll Forests
Sub-formation	Shrub/Grass
Class	Hunter-Macleay Dry Sclerophyll Forests
EEC analog	na
No. field sites	16
Total area	569.36 ha

Floristic Type	*Corymbia citriodora*
Association	*Corymbia citriodora - Allocasuarina torulosa - Themeda australis*

Community description

Tallest stratum

A tall to extremely tall open forest dominated by Spotted Gum *Corymbia citriodora.* Common associates include Grey Ironbark *Eucalyptus siderophloia*, Broad-leaved White Mahogany *Eucalyptus carnea,* Tallowwood *Eucalyptus microcorys* and Grey Gum *Eucalyptus propinqua* with scattered Pink Bloodwood *Corymbia intermedia*, White Stringybark *Eucalyptus globoidea* and the occasional Blackbutt *Eucalyptus pilularis*.

Mid stratum

A low to mid-high open woodland dominated by Forest Oak *Allocasuarina torulosa.* Common associates include Blackwood *Acacia melanoxylon* Brushbox *Lophostemon confertus*, Turpentine *Syncarpia glomulifera* and other species.

Lowest stratum

A mid-high to tall open grassland or sedgeland dominated by Blady Grass *Imperata cylindrica*, Spiny-headed Mat-rush *Lomandra longifolia* or Kangaroo Grass *Themeda australis*. Common associates include Coffee Bush *Breynia oblongifolia* Blue Flax-lily *Dianella caerulea*, Wiry Panic *Entolasia stricta*, *Persoonia stradbrokensis, Ottochloa gracillima* and Tussock Grass *Poa labillardieri* and other species.

Climbers and epiphytes include Large-leaved Staff Vine *Celastrus subspicata*, Water Vine *Cissus hypoglauca*, Yaroong *Cissus sterculifolia*, Wombat Berry *Eustrephus latifolius*, Scrambling Lily *Geitonoplesium cymosum*, Purple Coral Pea *Hardenbergia violacea*, Climbing Guinea Flower *Hibbertia scandens*, Elkhorn Fern *Platycerium bifurcatum*, Lawyer Vine *Smilax australis* and Thin-leaved Tylophora *Tylophora paniculata.*

Community Distribution	**Additional Information**
	**NRCMA AG-ID**: na
	Soil landscape: to be detailed
	Occurs with or near: PMVC_026 & 037
	General Distribution: This community is restricted to the Cooperabung and Beechwood erosional soil landscapes at Red Hill and Sancrox.
	Recorded weeds: to be detailed

PMVC_037. White Stringybark – Tallowwood – Grey Gum Dry Forest

Formation	Dry Sclerophyll Forests
Sub-formation	Grassy
Class	Hunter-Macleay Dry Sclerophyll Forests
EEC analog	na
No. field sites	11
Total area	950.14 ha

Floristic Type	*Eucalyptus globoidea*
Association	*Eucalyptus globoidea - Allocasuarina torulosa - Themeda australis*

Community description

Tallest stratum

A tall to very tall open forest dominated by White Stringybark *Eucalyptus globoidea* growing in association with Tallowwood *Eucalyptus microcorys*. Common associates include Broad-leaved White Mahogany *Eucalyptus carnea*, which occurs occasionally as a sub-dominant, Grey Gum *Eucalyptus propinqua* and Turpentine *Syncarpia glomulifera*, less commonly Red Bloodwood *Corymbia gummifera* and Grey Ironbark *Eucalyptus siderophloia*.

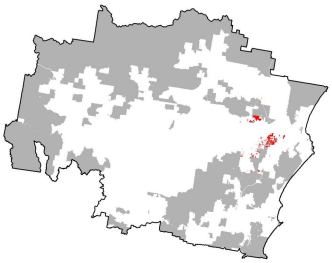
Mid stratum

A low to mid-high woodland dominated by Forest Oak *Allocasuarina torulosa* and to a lesser extent Black She-oak *Allocasuarina littoralis* growing in association with *Eucalyptus* saplings of the above species, Cheese Tree *Glochidion ferdinandi*, Large-leaf Hop-bush *Dodonaea triquetra*, Narrow-leaved Geebung *Persoonia linearis* and other species.

Lowest stratum

A mid-high to tall grassland and/or sedgeland dominated by Blady Grass *Imperata cylindrica* or Spiny-headed Mat-rush *Lomandra longifolia* growing in association with Common Bracken *Pteridium esculentum*, Kangaroo Grass *Themeda australis*, Wiry Panic *Entolasia stricta* and other species.

Climbers include Purple Coral Pea *Hardenbergia violacea*, Climbing Guinea Flower *Hibbertia scandens*, Dusky Coral Pea *Kennedia rubicunda* and Common Silkpod *Parsonsia straminea.*

Community Distribution	**Additional Information**
	**NRCMA AG-ID**: none applicable
	Soil landscape: to be detailed
	Occurs with or near: PMVC_028, 035 & 038
	General Distribution: coastal hinterland between Sancrox and Heron's Creek
	Recorded weeds: Introduced species recorded in this community include Lantana *Lantana camara*, Small Leaved Privet *Ligustrum sinense* and Jacaranda *Jacaranda mimosifolia.*

APPENDIX F

BioNet PCT Profiles

BioNet Vegetation Classification - Community Profile Report

Plant Community Type ID (PCT ID): 1215

PCT Name: Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion

Classification Confidence Level: 5-Very Low

Vegetation Description: Other Diagnostics Features: None; LandscapePosition: Occurs slopes and ridges of coastal foothills

Variation and Natural Disturbance:

Vegetation Formation: Dry Sclerophyll Forests (Shrub/grass sub-formation);

Vegetation Class: Hunter-Macleay Dry Sclerophyll Forests;

IBRA Bioregion(s): NSW North Coast; South Eastern Queensland;

IBRA Sub-region(s): Dalmorton; Chaelundi; Macleay Hastings; Karuah Manning; Clarence Sandstones;

LGA: Not Assessed

Lithology: Not Assessed

Landform Pattern: Not Assessed

Landform Element: Not Assessed

Emergent species: None

Upper Stratum Species: Corymbia maculata; Eucalyptus siderophloia; Eucalyptus carnea; Eucalyptus tereticornis; Eucalyptus moluccana; Eucalyptus microcorys;

Mid Stratum Species: Acacia implexa; Allocasuarina littoralis; Allocasuarina torulosa; Jacksonia scoparia; Xanthorrhoea johnsonii;

Ground Stratum Species: Aristida vagans; Dianella caerulea; Entolasia stricta; Themeda australis; Imperata cylindrica var. major;

Diagnostic Species: Not Assessed

Fire Regime:

TEC Assessed: Has associated TEC

TEC List: Listed BC Act,E: Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion (Part);

Associated TEC Comments:

PCT Percent Cleared: 35.00

PCT Definition Status: Approved

BioNet Vegetation Classification - Community Profile Report

Plant Community Type ID (PCT ID): 1262

PCT Name: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Classification Confidence Level: 5-Very Low
Vegetation Description: Other Diagnostics Features: Tall to very tall open forest.; LandscapePosition: Occurs on the coastal lowlands and foothills of the southern parts of the North Coast.
Variation and Natural Disturbance:
Vegetation Formation: Wet Sclerophyll Forests (Grassy sub-formation);
Vegetation Class: Northern Hinterland Wet Sclerophyll Forests;
IBRA Bioregion(s): NSW North Coast;
IBRA Sub-region(s): Macleay Hastings; Upper Manning; Mummel Escarpment; Tomalla; Upper Hunter; Karuah Manning;
LGA: Not Assessed
Lithology: Not Assessed
Landform Pattern: Not Assessed
Landform Element: Not Assessed
Emergent species: None
Upper Stratum Species: Eucalyptus microcorys; Eucalyptus propinqua; Eucalyptus siderophloia; Eucalyptus carnea; Syncarpia glomulifera; Lophostemon confertus;
Mid Stratum Species: Allocasuarina torulosa; Breynia oblongifolia;
Ground Stratum Species: Desmodium rhytidophyllum; Desmodium varians; Dianella caerulea; Glycine clandestina; Hibbertia scandens; Lomandra longifolia; Pseuderanthemum variabile; Themeda australis; Vernonia cinerea; Imperata cylindrica var. major;
Diagnostic Species: Not Assessed
Fire Regime:
TEC Assessed: No associated TEC
TEC List: Not Assessed
Associated TEC Comments:
PCT Percent Cleared: 30.00
PCT Definition Status: Approved

APPENDIX G

Threatened Species Likelihood of Occurrence

KEY	
Status	The "threatened species" listing in the *Threatened Species Conservation Act 1995* (TSC Act)
V	Species listed as "vulnerable", as defined under the TSC Act.
E1	Species listed as "endangered", as defined under the TSC Act.
E4A	Species listed as "critically endangered", as defined under the TSC Act.
E2	An "endangered population", as defined under the TSC Act.
Records	The number of records of the relevant "threatened species" listed in the search area
Likelihood of Occurrence	The likelihood of occurrence (LoO) of threatened species.
P	Present on the subject land
H	High potential occurrence
M	Moderate potential occurrence
L	Low potential occurrence
N	No relevance
Credit Type	According to Threatened Species Profile Database
Ecosystem	Ecosystem credit species
Species	Species credit species
NOTES	

Species listed in the table below are derived from the BioBanking Credit Calculator (Proposal ID 0107/2015/2368MP) and the *Atlas of NSW Wildlife* website http://www.bionet.nsw.gov.au/. The following notes accompany this database:

- Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions.
- Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1°; ^^ rounded to 0.01°).
- Copyright - the State of NSW through the Office of Environment & Heritage.
- Search criteria: Licensed Report of all Valid Records of Threatened (listed on TSC Act 1995) Entities in selected area [North: -31.36 West: 152.75 East: 152.98 South: -31.55] returned a total of 2,423 records of 80 species.
- Report generated on 15/10/2015 4:00 PM.

Threatened Species of Plants

Species	Habitat Description	Habitat on site	Records	Credit Type	BC Act Status	EPBC Act Status	Likelihood of Occurrence
Cryptostylis hunteriana Leafless Tongue Orchid	• Occurs in a range of communities, including swamp-heath and woodland • The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E. sieberi*), Red Bloodwood (*Corymbia gummifera*) and Black Sheoak (*Allocasuarina littoralis*)	• Marginal potential habitat occurs on site in very restricted locations in paperbark swamp forest margins • No presence of species detected on site	_	Species	V	V	Low
Acacia courtii North Brother Wattle	• Occurs on steep, dry, rocky slopes and in mixed dry forests on shallow soils, often under White Mahogany (*Eucalyptus acmenoides*) and Grey Gum (*Eucalyptus punctata*). • Only found in the Laurieton district occurring on North Brother, Middle Brother and South Brother Mountains	• Outside distribution range		Species	V	V	None
Diuris disposita Willawarrin Doubletail	• Requires grassy open forest • Known only from Willawarrin near Kempsey, NSW, where it is rare	• Outside distribution range	_	Species	E	_	None
Cynanchum elegans White-flowered Wax Plant	• Typical habitat is rainforest and littoral rainforest	• Habitat does not occur on site	1	Species	E1,P	E	None
Allocasuarina defungens	• Typical habitat is tall heath on sand	• Habitat does not occur on site	9	Species	E1,P	E	None

Species	Habitat Description	Habitat on site	Records	Credit Type	BC Act Status	EPBC Act Status	Likelihood of Occurrence
Dwarf Heath Casuarina							
Hibbertia hexandra Tree Guinea Flower	• Typically grows in heath, open forest or rainforest.	• Marginal potential habitat occurs, primary occurrence in Far Northern NSW, however separate occurrence in nearby Wauchope-Kendall area.		Species	E		Low
Maundia triglochinoides	• Grows in swamps, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients.	• Marginal potential habitat occurs on site in very restricted locations in paperbark swamp forest margins • No presence of species detected on site	3	Species	V,P	_	Low
Eucalyptus nicholii Narrow-leaved Black Peppermint	• Typical habitat is dry grassy woodland • Distribution range is NE tablelands	• Outside distribution range	3	Species	V	V	None
Marsdenia longiloba Slender Marsdenia	• Subtropical and warm temperate rainforest, lowland moist or open eucalypt forest adjoining rainforest and, sometimes, in areas with rock outcrops • Scattered sites on the north coast of NSW north from Barrington Tops; also occurs in south-east Queensland • Associated species include Eucalyptus crebra, E. microcorys, E. acmenoides, E. saligna, E. propinqua, Corymbia intermedia, and Lophostemon confertus	• Marginal potential habitat occurs on site in very restricted locations in paperbark swamp forest margins • Not recorded on site during flora survey	_	Species	E	V	Low

Species	Habitat Description	Habitat on site	Records	Credit Type	BC Act Status	EPBC Act Status	Likelihood of Occurrence
Melaleuca groveana Grove's Paperbark	• Grows in heath and shrubland, often in exposed sites, in low coastal hills, escarpment ranges and tablelands on outcropping granite, rhyolite and sandstone on rocky outcrops and cliffs • Also occurs in dry scrubby open forest and woodlands • Widespread, scattered populations in coastal districts north of Yengo National Park (Southwest of Newcastle, NSW) to southeast Queensland	• Habitat does not occur on site	_	Species	V	_	Low
Melaleuca biconvexa Biconvex Paperbark	• Typically grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspect • Only found in NSW, with scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford- • Wyong area in the north.	• Outside distribution range	27	Species	V	V	Low
Niemeyera whitei Rusty Plum	• Found in gullies of warm temperate or littoral rainforests and the adjacent understorey of moist eucalypt forest • Occurs on poorer soils in areas below 600 m above sea level • Rusty Plum occurs in the coast and adjacent ranges of northern NSW from the Macleay River into southern Queensland • Its distributional stronghold is on the mid north coast around Coffs Harbour	• Marginal potential habitat occurs on site in very restricted locations in paperbark swamp forest margins • Not recorded onsite during flora survey	_	Species	V	_	Low

Species	Habitat Description	Habitat on site	Records	Credit Type	BC Act Status	EPBC Act Status	Likelihood of Occurrence
Parsonsia dorrigoensis Milky Silkpod	• Found in subtropical and warm-temperature rainforest, on rainforest margins, and in moist eucalypt forest up to 800m, on brown clay soils • Found only within NSW, with scattered populations in the north coast region between Kendall and Woolgoolga	• Marginal potential habitat occurs on site in very restricted locations in paperbark swamp forest margins	_	Species	V	E	Low
Dendrobium melaleucaphilum Spider orchid	• Typical habitat is swamp – specifically parasitic on *Melaleuca styphelioides* • Flowers from July to October	• One specimen of an epiphytic *Dendrobium* orchid was recorded on an individual *Melaleuca styphelioides* near the western edge of the site • Identification to species level not possible until next flowering period July 2016	1	Species	E1	_	Low
Phaius australis Southern swamp orchid	• Typical habitat is Melaleuca quinquenervia swamps and sclerophyll forest on the coast. • Occurs in Queensland and north-east NSW as far south as Coffs Harbour. Historically, it extended farther south, to Port Macquarie. • Flowers October-November	• Moderate potential habitat occurs on site in the paperbark swamp forest and dry sclerophyll forest • One record within 10km of site only • No occurrence detected during flora survey	1	Species	E1	E	Moderate
Pomaderris queenslandica Scant Pomaderris	• Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks • Widely scattered but not common in north-east NSW and in Queensland • Known from several locations on the NSW north coast and a few locations on	• Habitat does not occur on site	_	Species	E	_	Low

Species	Habitat Description	Habitat on site	Records	Credit Type	BC Act Status	EPBC Act Status	Likelihood of Occurrence
	the New England Tablelands and North West Slopes • Flowers during spring/summer						
Senna acclinis Rainforest Cassia	• Grows on the margins of subtropical, littoral and dry rainforests • Occurs in coastal districts and adjacent tablelands of NSW from the Illawarra in NSW to Queensland • Flowering occurs in spring and summer; fruit is ripe summer and autumn	• Potential habitat occurs on site in the paperbark swamp forest • No occurrence detected during flora survey	_	Species	E	_	Low

Threatened Species of Animal

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
AMPHIBIANS							
Crinia tinnula Wallum Froglet	• Typical habitat is acidic swamps on coastal sand plains - sedgelands, wet heathlands, paperbark swamps and drainage lines • Also persist in disturbed areas • Breeding occurs in winter months and can occur in permanent water in swamps or more ephemeral habitats • Shelter under leaf litter, vegetation, other debris or in burrows of other species often located near the water's edge	• Marginal potential habitat occurs on site in paperbark swamp forest and low lying areas • No occurrence detected on site during fauna survey (noting that rain fell during survey period)	52	Species	V,P	_	Low

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
Litoria aurea Green & Golden Bell Frog	• Typical habitat includes marshes, dams and stream-sides – particularly with *Typha* and *Eleocharis* spp. • Prefers unshaded waterbodies, with a grassy area nearby and diurnal sheltering sites • Active by day and usually breeds in summer when conditions are warm and wet	• Suitable habitat may exist on site in paperbark swamp forest areas, quarry water dam and western farm dam • Presence of *Gambusia holbrooki* found in all ponds may prevent establishment on site • No occurrence detected on site during fauna survey (noting that rain fell during survey period)	2	Species	E1,P	V	Low
Litoria brevipalmata Green-thighed Frog	• Occurs in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath – typically in areas that pond after rain • Breeding occurs following heavy rainfall from spring to autumn • Isolated localities along the coast and ranges from just north of Wollongong to south-east Queensland	• Suitable habitat may exist on site in paperbark swamp areas and low lying areas • No occurrence detected on site during fauna survey (noting that rain fell during survey period)	20	Species	V,P	_	Low
Mixophyes iteratus Giant Barred Frog	• Associated with flowing streams, often in rainforest or wet sclerophyll forest • Generally lives in large streams or rivers with a width of at least 5 metres	• No suitable habitat exists on site as it prefers flowing streams	1	Species	E1,P,2	E	Low
BIRDS							
Amaurornis moluccana	• Key elements of their habitat are dense undergrowth 2 to 4 metres	• Suitable habitat may exist on site in paperbark swamp forest		Species	V		Low

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
Pale-vented Bush-hen	tall and within 300 metres of water.	areas, quarry water dam and western farm dam					
Anthochaera phrygia Regent Honeyeater	• Mostly occur in Dry Box-Ironbark eucalypt woodland and dry sclerophyll forest associations in areas of low to moderate relief • Inhabit woodlands with significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. • In NSW, riparian forests containing River Oak *Casuarina cunninghamiana*, and with Needle-leaf Mistletoe *Amyema cambagei*, are important for feeding and breeding. • Known to breed in three areas, two of them in NSW - Capertee Valley and Bundarra-Barraba regions • Breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak.	• Low breeding habitat potential onsite due to small number of mature trees, open canopy, and lack of preferred woodland tree species • May be suitable foraging habitat in winter	2	Species	E4A,P	CE	Low
Botaurus poiciloptilus Australasian Bittern	• Favours permanent freshwater wetlands with tall, dense vegetation, particularly bull rushes (*Typha* spp.) and spike rushes (*Eleocharis* spp.). • Nests in secluded places in densely vegetated wetlands on a platform of reeds	• Limited habitat occurs on site around fringes of freshwater dams • Not recorded on site during fauna survey	4	Species	E1,P	E	Low

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
Burhinus grallarius Bush Stone-curlew	• Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. • Nests on ground in scrape or small bare patch. Lays two eggs in spring or early summer • Largely nocturnal, being especially active on moonlit nights. • Feed on insects and small vertebrates, such as frogs, lizards and snakes	• Potential habitat occurs on site in Spotted Gum Grassy Dry Forest • Low breeding habitat potential as dense shrubs for nesting are predominantly absent	2	Ecosystem	E1, P	_	Low
Calyptorhynchus lathami Glossy Black Cockatoo	• Highly dependent on the distribution of *Allocasuarina* species, and is found in woodland dominated by *Allocasuarina* and in open forests where it forms a substantial middle layer. • Requires tree-hollows for breeding.	• Suitable potential habitat exists on site with presence of mid-canopy species *Allocasuarina littoralis* and *Allocasuarina torulosa* • Limited number of tree hollows available may limit breeding potential • Not recorded on site during fauna survey	65	Ecosystem	V,P,2	_	Moderate
Charadrius mongolus Lesser Sand-plover	• Coastal, favouring the beaches of sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats	• Habitat does not occur on site	56	Species	V,P	C,J,K	None
Circus assimilis Spotted Harrier	• A widely dispersing species that prefers more open habitats, such as grassy open woodland, inland riparian woodland, grassland and shrub steppe	• Habitat available on site, largely vagrant - unlikely to occur apart from possible foraging activity • Found most commonly in native grassland.	2	Ecosystem	V,P	_	Low

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
Climacteris picumnus victoriae Brown Treecreeper (Eastern subspecies)	• Typical habitat is dry open forests and woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species. • Hollows >6cm in live trees or in dead standing or fallen timber necessary for breeding • Up to 80% of the diet is comprised of ants, then other invertebrates and nectar	• Potential habitat (White stringybark-Tallowwood-Grey Gum dry forest) occurs on site • Limited number of tree hollows available may limit breeding potential • Not recorded on site during fauna survey	3	Ecosystem	V,P	_	Low
Coracina lineata Barred Cuckoo-shrike	• Typical habitat is rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses. • Occur in coastal eastern Australia from Cape York to the Manning River in NSW; Generally uncommon in their range, and are rare in NSW.	• Mixed eucalypt woodland habitat occurs on site • Not recorded on site during fauna survey	1	Ecosystem	V,P	_	Moderate
Daphoenositta chrysoptera Varied Sittella	• Found in eucalypt woodlands and forests throughout their range • Prefer rough-barked trees (like Stringybarks and Ironbarks) or mature trees with hollows or dead branches • Usually seen in flocks, moving swiftly between trees or foraging busily over branches or the trunk • Often quite noisy while feeding	• Moderate potential habitat occurs throughout site • Limited number of tree hollows available may limit breeding potential	23	Ecosystem	V,P	_	Moderate

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
Carterornis leucotis White-eared Monarch	• Occur in littoral rainforest, wet and dry sclerophyll forests, swamp forest, and regrowth forest • In NSW, White-eared Monarchs are generally found from the Queensland border south to Iluka at the mouth of the Clarence River, and inland as far as the Richmond Range. There are occasional records south of the Clarence River, near Woolgoolga and around Port Macquarie • Breed from Sept to March and nest high in the canopy	• Potential habitat occurs throughout site in mixed eucalypt woodland and paperbark swamp forest areas • Not recorded on site during fauna survey	_	Species	V	_	Moderate
Dromaius novaehollandiae Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	• The populations in NSW occur in a range of predominantly open lowland habitats - grasslands, heathland, shrubland, open and shrubby woodlands, forest, and swamp and sedgeland communities	• No suitable habitat occurs on site	1	Species	E2	_	None
Ephippiorhynchus asiaticus Black-necked Stork	• Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat • Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries.	• No suitable habitat occurs on site	45	Species	E1,P	_	Low
Esacus magnirostris Beach Stone-curlew	• Restricted to coastal habitats including beaches, islands, reefs and in estuaries	• No suitable habitat occurs on site	1	Species	E4A,P	_	None

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
Glossopsitta pusilla Little Lorikeet	• Forages primarily in the canopy of open *Eucalyptus* forest and woodland, yet also finds food in *Angophora, Melaleuca* and other tree species • Roosts in treetops, often distant from feeding areas • Nesting season extends from May to September • Distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury • Nomadic movements are common, influenced by season and food availability	• Potential habitat (Eucalyptus woodland) occurs throughout the site • Not recorded on site during fauna survey	16	Ecosystem	V,P	_	Moderate
Haematopus fuliginosus Sooty Oystercatcher	• Typical habitat is rocky headlands, rocky shelves, exposed reefs with rock pools, beaches and muddy estuaries	• No suitable habitat occurs on site	3	Species	V,P	_	None
Haematopus longirostris Pied Oystercatcher	• Typical habitat is intertidal flats of inlets and bays, open beaches and sandbanks	• No suitable habitat occurs on site	13	Species	E1,P	_	None
Hieraaetus morphnoides Little Eagle	• A wide-ranging species that occurs in a variety of habitats, but mainly occupies open eucalypt forest, woodland or open woodland	• Potential habitat occurs in eucalypt woodland areas throughout site • Not recorded on site during fauna survey	1	Ecosystem	V,P	_	Moderate

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
	• Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter	• One record of occurrence within 10km of site					
Irediparra gallinacean Comb-crested Jacana	• Inhabit permanent freshwater wetlands that are either still or slow-flowing, with a good surface cover of floating vegetation, especially water-lilies, or fringing and aquatic vegetation	• No suitable habitat occurs on site	1	Species	V,P	_	None
Ixobrychus flavicollis Black Bittern	• Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation • Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves	• No suitable habitat occurs on site	1	Species	V,P	_	None
Lathamus discolour Swift Parrot	• Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes • Favoured feed trees include winter flowering species such as Eucalyptus robusta, Corymbia maculata, C. gummifera, East of the Divide; E. sideroxylon, and E. albens West of the Divide	• Potential but limited foraging habitat occurs on site- *Corymbia maculata* and *Corymbia gummifera* occur as secondary canopy species	4	Ecosystem	E1,P,3	E	Low

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
Lophoictinia isura Square-tailed Kite	• This wide-ranging species is found in a variety of habitats including dry woodlands and open forests • Prefers timbered watercourses, particularly for nesting sites • Occupies large home range over 100km^2	• Theoretical habitat availability due to large home ranges • Low quality nesting habitat (preferred near to watercourses)	33	Ecosystem	V,P,3	_	Moderate
Melanodryas cucullata cucullata Hooded Robin	• Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas • Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses • Found from Brisbane to Adelaide and throughout much of inland NSW, with the exception of the extreme north-west	• Limited potential habitat • Eucalyptus woodland occurs on site but is lacking structural diversity based on past logging history	_	Ecosystem	V	_	Low
Ninox connivens Barking Owl	• Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland • Flexible in its habitat use and hunting can extend in to closed forest and more open areas • Larger trees and hollow trees facilitate more abundant prey base for hunting and breeding success • Sometimes able to successfully breed along timbered	• Moderate potential habitat occurs on site but large nesting hollows are scarce • Given a large home range, unlikely to occur apart from foraging activity	2	Ecosystem	V,P,3	_	Moderate

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
	watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile soils						
Ninox strenua Powerful Owl	• Found in open forests and woodlands, as well as along sheltered gullies in wet forests with dense understoreys, especially along watercourses. Will sometimes be found in open areas near forests such as farmland, parks and suburban areas, as well as in remnant bushland patches • Needs old growth trees to nest. • Occupies very large home ranges	• Moderate quality habitat occurs on site, but large nesting hollows are scarce • Given a large home range, unlikely to occur apart from foraging activity	12	Ecosystem	V,P,3	_	Low
Oxyura Australis Blue-billed Duck	• Completely aquatic species, preferring deep water in large permanent wetlands and swamps with dense aquatic vegetation • Semi-migratory, dispersing up to 300km to breed in deep swamps • Most common in the southern Murray-Darling Basin area - generally only in coastal areas during summer or dry years	• Potential habitat availability in large quarry dams (in disturbed quarry area), prefers dense aquatic vegetation • No habitat occurs in proposed expansion area	1	Ecosystem	V,P	_	Low
Pandion cristatus Eastern Osprey	• Favour coastal areas, especially the mouths of large rivers, lagoons and lakes	• No suitable habitat occurs on site	44	Species	V,P,3	_	Low
Petroica boodang Scarlet Robin	• Lives in open forests and woodlands • Active throughout the day	• Potential habitat (mixed eucalypt woodland) occurs on site	1	Ecosystem	V,P	_	Moderate

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
	• During winter, it will visit more open habitats such as grasslands and farmland	• Not recorded on site during fauna survey					
Ptilinopus magnificus Wompoo Fruit-Dove	• Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests • Occurs along the coast and coastal ranges from the Hunter River in NSW to Cape York Peninsula, though rare south of Coffs Harbour	• No suitable habitat occurs on site	_	Ecosystem	V	_	Low
Ptilinopus regina Rose-crowned Fruit-Dove	• Sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful • Numbers increase in Spring and Summer in response to food availability in NE NSW	• No habitat availability, prefers rainforest and occasionally moist eucalypt forest, unlikely to occur	1	Ecosystem	V,P	_	None
Stagonopleura guttata Diamond Firetail	• Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum *Eucalyptus pauciflora* Woodlands • Endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia • Not commonly found in coastal districts	• Potential habitat (Spotted Gum Grassy Dry-Forest) occurs on site, dense shrubs for nesting predominantly absent	_	Ecosystem	V	_	Low
Sternula albifrons Little Tern	• Typical habitat is coastal, preferring sheltered environments • Nests in low dunes or on sandy beaches near estuary mouths, lakes and islands	• No habitat available on the site	12	Species	E1,P	C,J,K	None

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
Turnix maculosus Red-backed Button Quail	• Mainly a species of coastal and subcoastal regions • In NSW, occurs in grasslands, heath and crops. Prefers sites close to water, especially when breeding. • The species has been observed associated with the following grasses (in various vegetation formations): Speargrass, Blady Grass, Triodia, Sorghum and Buffel Grass.	• No suitable habitat occurs on site, prefers grasslands, heath and crops	_	Species	V	_	None
Tyto longimembris Eastern Grass Owl	• Typical habitat is tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains	• Low habitat availability, prefers areas with tall grass, including tussocks, grassy plains, swampy areas or sedges on floodplains	22	Ecosystem	V,P,3	_	Low
Tyto novaehollandiae Masked Owl	• Typical habitat is dry eucalypt forest and woodland • Roosts and breeds in moist eucalypt forested gullies • Large home-range of 500 to 1000 hectares	• Habitat available on site, large hollow nesting habitat scarce, nearby records to site (within 2km). Unlikely to occur apart from foraging activity	18	Ecosystem	V,P,3	_	Moderate
Tyto tenebricosa Sooty Owl	• Typical habitat is rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests • Requires very large tree-hollows for nesting	• Low habitat availability, large hollow nesting habitat scarce, prefers rainforest or moister forest types	3	Ecosystem	V,P,3	_	Low
Xenus cinereus Terek Sandpiper	• Typical habitat includes coastal mudflats, lagoons, creeks and estuaries	• No habitat available on the site	3	Species	V,P	C,J,K	None

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
MAMMALS							
Aepyprymnus rufescens Rufous Bettong	• Inhabit a variety of forests from tall, moist eucalypt forest to open woodland, with a tussock grass understorey. A dense cover of tall native grasses is the preferred shelter • They sleep during the day in cone-shaped nests constructed of grass in a shallow depression at the base of a tussock or fallen log	• Potential habitat in woodland areas, native grasses in ground layer unlikely tall or dense enough for favourable habitat	1	Species	V,P	_	Moderate
Dasyurus maculatus Spotted-tailed Quoll	• Found in a range of forest habitats, from rainforest to open woodland but seem to prefer moist forests such as rainforests and closed eucalypt forest • Requires forest with suitable den sites such as rock crevices, caves, hollow logs, burrows and tree-hollows	• Potential habitat availability on site , more so in gullies. Foraging habitat available although den opportunities are scarce. Large home ranges.	32	Ecosystem	V,P	E	Low
Cercartetus nanus Eastern Pygmy Possum	• Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath • Found in south-eastern Australia, from southern Queensland to eastern South Australia and Tasmania • In Northern NSW, most often found in rainforest	• Possible habitat availability in woodland areas although lack of understorey and sparsity of trees may be a deterrent. Flowering shrubs are very sparse on the site and shelter habitat such as tree hollows is limited.	None	Species	V	_	Low

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
	• Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes • Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum dreys or thickets of vegetation.						
Chalinolobus nigrogriseus Hoary Wattled Bat	• Occurs in dry open eucalypt forests, favouring forests dominated by Spotted Gum, boxes and ironbarks, and heathy coastal forests where Red Bloodwood and Scribbly Gum are common. Because it flies fast below the canopy level, forests with naturally sparse understorey layers may provide the best habitat.	• Foraging habitat available on site. Limited roosting habitat available due to scarcity of hollow-bearing trees or rock crevices.	1	Ecosystem	V,P	_	Moderate
Falsistrellus tasmaniensis Eastern False Pipistrelle	• Prefers moist habitats, with trees taller than 20 m. • Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	• Foraging habitat available on site, roosting habitat (hollow-bearing trees) are scarce. Recorded on site as possible identification (Anabat data likely to be confused with calls with those of other bat species)	2	Ecosystem	V,P	_	Present (AnaBat record, possible confidence)
Kerivoula papuensis Golden-tipped Bat	• Typical habitat is rainforest and adjacent wet and dry sclerophyll forest • Roosts on small steams in rainforest gullies – roosting in small in abandoned hanging bird nests, tree hollows, dense foliage and epiphytes	• Moderate habitat availability prefers rainforest or forest adjacent to rainforest. Roosts mainly in rainforest gullies - unlikely to occur apart from foraging activity.	5	Ecosystem	V,P	_	Moderate

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
	• Specialist feeder on small web-building spiders						
Macropus parma Parma Wallaby	• Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest	• Low habitat available, prefers moist eucalypt forests and rainforest margins.		Species	V		Low
Miniopterus australis Little Bentwing-bat	• Moist environments where it roosts in large numbers in caves, old mines, stormwater tunnels and occasionally buildings. • Forages in forests and woodlands and grassland.	• Foraging habitat available on site. Breeding and roosting habitat absent due to scarcity of caves or similar habitat. Recorded on site by Anabat detection.	68	Species	V,P	_	Present (AnaBat record, Confident confidence)
Miniopterus schreibersii oceanensis Eastern Bentwing-bat	• Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. • Hunt in forested areas, catching moths and other flying insects above the tree tops	• Foraging habitat available on site. Breeding and roosting habitat absent due to scarcity of caves or similar habitat. Recorded on site by Anabat detection as probable Identification. (Some possibility of confusion of calls with those of other bat species).	28	Ecosystem & Species	V,P	_	Present (AnaBat record, Probable confidence)
Mormopterus norfolkensis Eastern Freetail Bat	• Can be found in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. • Roost mainly in tree-hollows, but will also roost under bark or in man-made structure.	• Foraging habitat available on site. Limited roosting habitat available due to scarcity of hollow-bearing trees. Recorded on site by Anabat detection.	20	Ecosystem	V,P	_	Present (AnaBat record, Confident confidence)

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
	• Most active in summer months, just after dusk and during the night.						
Myotis macropus Southern Myotis	• Often roosts in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. • Forages over streams and pools. • Most active in summer months, just after dusk and during the night.	• Foraging habitat available on site particularly near larger waterbodies in quarry area. Roosting habitat such as caves, mine shafts or hollow-bearing trees is rare or absent.	18	Ecosystem & Species	V,P	_	Moderate
Petaurus australis Yellow-bellied Glider	• Found in mature eucalypt forests in temperate to subtropical regions of eastern Australia. • Inhabits a wide range of forest types but prefers resource rich forests where mature trees provide nesting hollows. • Winter-flowering eucalypts provide nectar and pollen, and some eucalypts are suitable for tapping sap.	• Limited potential habitat occurs in woodland areas throughout site • Foraging habitat is available but large hollow bearing trees for nesting are scarce	9	Ecosystem	V,P	_	Low
Petaurus norfolcensis Squirrel Glider	• Typical habitat in coastal areas is Blackbutt-Bloodwood forest with heath understorey. • Prefers mixed species stands with a shrub or Acacia midstorey.	• Potential habitat in woodland areas but lack of understorey for foraging and tree hollows for shelter would likely be a deterrent	24	Species	V,P	_	Moderate
Phascogale tapoatafa Brush-tailed Phascogale	• Typical habitat is dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter.	• Moderate potential habitat in woodland areas throughout site • Not recorded on site during fauna survey	5	Species	V,P	_	Moderate

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
	• Also inhabit heath, swamps, rainforest and wet sclerophyll forest.						
Phascolarctos cinereus Koala	• Lives in eucalypt woodlands and forests. • Home range size varies according to quality of habitat, ranging from less than two hectares to several hundred hectares. • Most active in summer months during breeding season	• Potential koala habitat according to Clause 7 of SEPP 44 present on site. • No breeding population present (meaning no core koala habitat). • One group of old scats observed on ridgetop of site, numerous possible koala scratches (old) observed on Grey Gum trunks across the site	805	Species	V,P	V	Present (historical indirect evidence)
Potorous tridactylus Long-nosed Potoroo	• Inhabits coastal heaths and dry and wet sclerophyll forests; sandy loam soil is a common feature. • Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. • In NSW, generally restricted to coastal heaths and forests east of the Great Dividing Range, with an annual rainfall exceeding 760 mm	• Limited potential habitat occurs on site although lack of dense understory would likely be a deterrent for this species	_	Ecosystem	V	V	Low
Planigale maculate Common Planigale	• Typical habitat is rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water	• Potential habitat occurs in woodland areas and paperbark swamp forest areas • Not detected on site during fauna survey	4	Species	V,P	_	Moderate

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
	• Shelters and breeds in hollow logs, under bark, rocks, cracks in soil, grass tussocks or building debris • Distribution is Coastal north-eastern NSW, coastal east Queensland and Arnhem Land						
Pseudomys gracilicaudatus Eastern Chestnut Mouse	• Typical habitat is heathland mainly in dense, wet heath and swamps • Mainly occurs north from the Hawkesbury River area as scattered records along to coast and eastern fall of the Great Dividing Range extending north into Queensland	• Marginal potential habitat in paperbark swamp forest areas • Not detected on site during fauna survey	14	Species	V,P	_	Low
Pteropus poliocephalus Grey-headed Flying Fox	• Utilises vegetation communities including rainforests, open forests, closed and open woodlands. • Roost sites are typically located near water, such as lakes, rivers or the coast • Forages primarily for eucalypt blossom and related genera but in some areas it also utilises a wide range of rainforest and cultivated fruits.	• Foraging habitat available in flowering eucalypts on site • Species were detected during spotlight survey • No camps detected on site or adjacent survey	121	Ecosystem & Species	V,P	V	Present (foraging individuals observed and heard)
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	• Forages in most habitats (with and without trees) across its very wide range, • Roost in groups in tree hollows and buildings - also known to utilise mammal burrows	• Foraging habitat available on site • Limited roosting habitat available due to scarcity of hollow-bearing trees • Recorded on site by Anabat detection as a *possible*	2	Ecosystem	V,P	_	Present (AnaBat record, Confident confidence)

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
		Identification (likely to be confused with calls with those of other bat species).					
Scoteanax rueppellii Greater Broad-nosed Bat	• Rainforest, wet and dry sclerophyll and woodland. • Usually roosts in tree-hollows. • Forages over streams and pools. • Most active in summer months, just after dusk and during the night.	• Foraging habitat available on site. Limited roosting habitat available due to scarcity of hollow-bearing trees. Recorded on site by Anabat detection.	18	Ecosystem	V,P	_	Present (AnaBat record, Probable confidence)
Thylogale stigmatica Red-legged Pademelon	• Inhabits forest with a dense understorey and ground cover, including rainforest, moist eucalypt forest and vine scrub. • Patchily distributed along coastal and subcoastal eastern Australia from Cape York to the Hunter Valley in NSW	• Limited potential habitat on site although lack of dense understory would likely be a deterrent for this species.	_	Ecosystem	V	_	Low
Vespadelus troughtoni Eastern Cave Bat	• A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.	• Foraging habitat available on the site • Roosting habitat (caves) is absent.	10	Ecosystem & Species	V,P	_	Low
Syconycteris australis Common Blossom-bat	• Often roost in littoral rainforest and feed on nectar and pollen from flowers in adjacent heathland and paperbark swamps • Also recorded in subtropical rainforest, wet sclerophyll forest and other coastal forests	• Low habitat availability, prefers littoral rainforest for roosting and feeds in heath or paperbark swamps • Occasionally occurs in wet sclerophyll forests	1	Ecosystem	V,P	_	Low

Species	Habitat Description	Habitat on site	Records	Credit Type	NSW Status	EPBC Act	LoO
REPTILES							
Coeranoscincus reticulatis Three-toed Snake-tooth Skink	• Rainforest and occasionally moist eucalypt forest, on loamy or sandy soils • Occurs on the coast and ranges from the Macleay valley in NSW to south-eastern Queensland. • Very uncommon south of Grafton.	• Low habitat availability prefers rainforest and occasionally moist eucalypt forest, on loamy or sandy soils. • Outside normal distribution range	_	Species	V	V	Low
Hoplocephalus bitorquatus Pale-headed Snake	• Found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest • Patchy distribution from NE Queensland to NE quarter of NSW • Highly cryptic tree dwelling species that can spend weeks at a time hidden in tree hollows	• Potential habitat available though low occurrence of tree hollows would likely be a deterrent for this species	_	Species	V	_	Moderate
Hoplocephalus stephensii Stephens Banded Snake	• Occurs in rainforest and eucalypt forests and rocky areas up to 950 m in altitude • Coast and ranges from Southern Queensland to Gosford in NSW	• Low habitat availability, prefers rainforest and moist eucalypt forests and rocky areas	_	Species	V	_	Low

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APPENDIX H

Koala Survey Report

SANCROX QUARRY EXPANSION PROJECT (SSD 7293)

Koala Survey and Assessment

Prepared for:

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SLR Ref: 630.11478-R01
Version No: -v2.2
December 2020

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Hanson Heidelberg Cement Group (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.11478-R01-v2.2	30 December 2020	Caitlin Cross and Amanda Lane (Biolink)	J Pepper	J Pepper

EXECUTIVE SUMMARY

Project Description and Background

Hanson Heidelberg Cement Group Pty Ltd (Hanson) is seeking project approval for the expansion of the existing Sancrox hard rock quarry. The Sancrox Quarry Expansion Project (SSD-7293) will involve extending the life of the quarry to 30 years and increasing approved extraction limits of 175, 00m^3. In their updated submission on the EIS, the Department of Planning, Industry and Environment requested the Biodiversity Assessment Report (BAR) should be amended to calculate required species credits for the Koala.

As part of the response to submissions on the EIS, Hanson has engaged SLR and Biolink to conduct supplementary surveys across the Sancrox project site to determine current Koala utilisation of the site and to update the assessment of impacts on the Koala. The aim of these surveys is to address the BCD concerns regarding impacts on the Koala and revaluate the ecological importance of the site for the local population of Koala.

Field Survey and results

Field surveys were conducted by SLR Consulting and Biolink on the 12-13 October 2020. These surveys included using RGb-SAT and nocturnal (spotlighting) surveys. Koala faecal pellets were recorded at eight of the 15 sampled field sites, and of the eight sites, four returned significant activity levels of 'medium' or 'high' use. One Koala was sighted during nocturnal spotlighting transects approximately 50 m west of the existing quarry wall. This is indicated the presence of one or more resident Koalas within the site.

Discussion

Ecological analysis of Koala activity levels identified two Koala activity cells adjoining the western edge of the quarry, reaching both the northern and southern boundary of the site, as well as another cell in the western portion of the site. Survey data implies the site as a high use area, with one or more resident Koalas within the study area.

Based on the current survey results and modelled activity levels, combined with previous Koala survey results, and the widespread occurrence of several Koala feed trees within the forested parts of the site, the site is considered to be habitat for the Koala, as a species credit species under the Framework for Biodiversity Assessment. The total area of Koala habitat within the site is estimated to be around 42.6 hectares.

The removal of Koala habitat associated with the proposed expansion of the Sancrox Quarry will reduce the availability of foraging and breeding habitat for the local Koala population and will increase barriers to local movement and dispersal of Koalas in the locality, particularly in a north-south direction.

Conclusion

On the basis of the current findings, and with reference to the procedures for calculating impacts on species credit species in the Framework for Biodiversity Assessment, a species polygon should be drawn for all areas of Koala habitat removal on the site and the associated species credits for the Koala calculated.

CONTENTS

CONTENTS

DOCUMENT REFERENCES

TABLES

FIGURES

APPENDICES

1 Introduction

1.1 Background

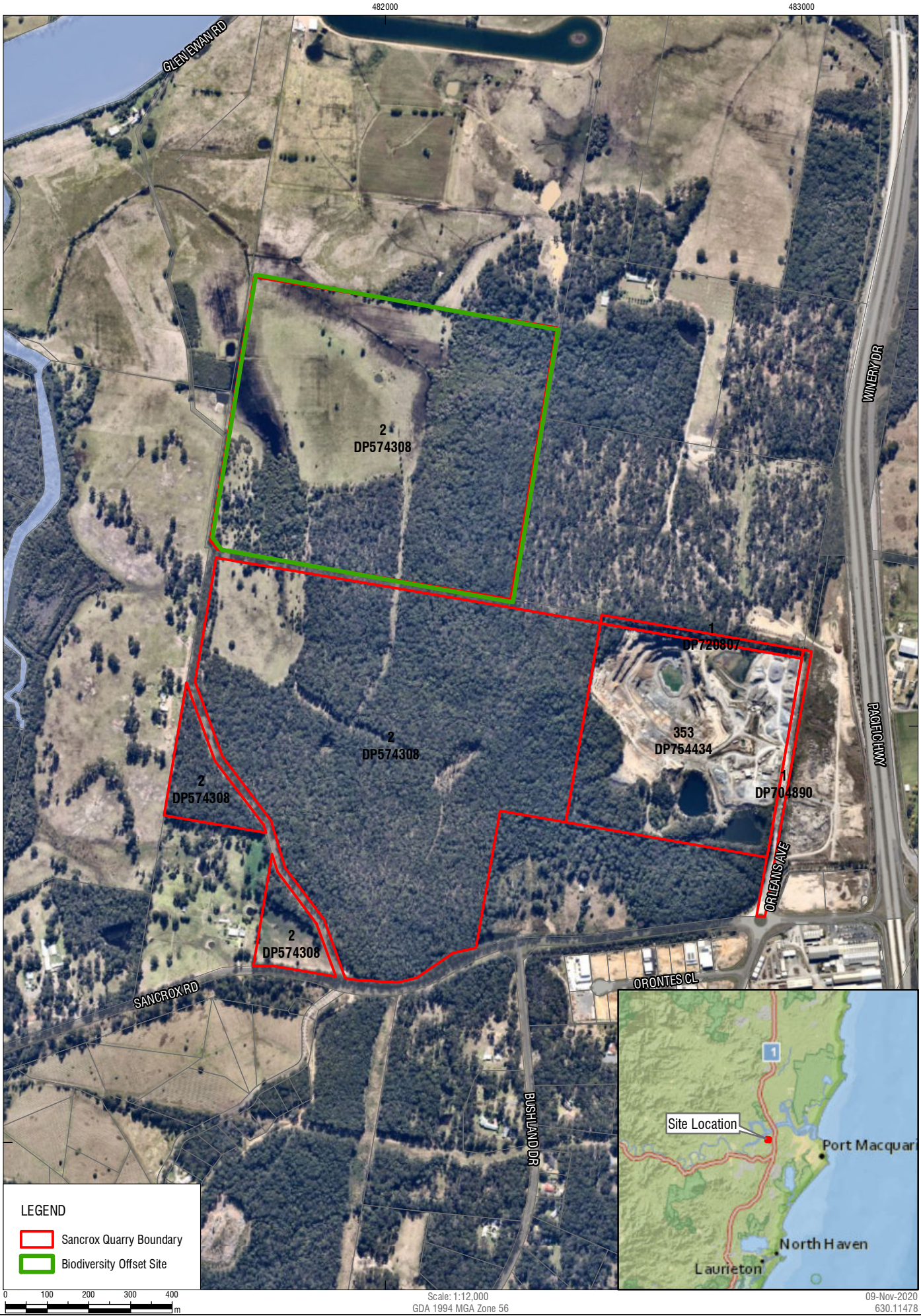
Hanson Heidelberg Cement Group Pty Ltd (Hanson) is seeking project approval for the expansion of the existing Sancrox hard rock quarry. The Sancrox Quarry Expansion Project will involve extending the life of the quarry to 30 years and increasing approved extraction limits by 175, 000 m^3. The Sancrox Quarry Expansion Project (SSD-7293) is a State Significant Development (SSD) as defined under *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) and will require development consent under Part 4, Division 4.1 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act). Hanson has prepared an environmental impact statement (EIS) according to the requirements for SSD projects and the EIS has been submitted and exhibited. As part of the preparation of the EIS, SLR prepared a Biodiversity Assessment Report in accordance with the *Framework for Biodiversity Assessment* (FBA, OEH 2014a).

In the updated submission on the EIS (see letter DOC20/211538, dated 3 April 2020), the Department of Planning, Industry and Environment (DPIE), Biodiversity Conservation Division (BCD) commented, *inter alia*, as follows: "As evidence of the koala has been previously recorded on site, the BAR should be amended to calculate the required species credits". In response to the BCD submission, Hanson has engaged SLR and Biolink to conduct supplementary surveys across the Sancrox project site ('the site') to determine current Koala utilisation of the site. The aim of these surveys is to address the BCD concerns regarding impacts and revaluate the ecological importance of the site for the local population of Koala. Subsequently, a determination can be made on whether the impacts of the project on Koala habitat will necessitate the generation and purchase of Koala species credits according to the FBA. The results and conclusions of the report are based on field surveys and data provided by Biolink in combination with the assistance of SLR ecology staff.

Several surveys targeting the Koala have been completed on the Sancrox site and within the wider Port Macquarie Hastings local government area over recent years (see **Section 3.1**). Most recently, Koala surveys were conducted by SLR in late 2015 as part of the Biodiversity Assessment Report (BAR) for the SSD application (see SLR 2019). The results of those surveys indicated that Koala activity levels were 'Low' according to the Spot Assessment Technique (SAT) criteria. On this basis, species credits for the Koala were not calculated (in accordance with the FBA) to address impacts on Koala habitat as a result of the proposed development.

1.2 Site Location and Description

Sancrox Quarry (the Study Area) is located on Lot 353 DP754434 and on Lot 2 DP574308, north-east of the Sancrox Road and Frogs Road intersection approximately 8 km west of Port Macquarie, in the Port Macquarie-Hastings Local Government Area (**Figure 1**). The majority of the study area is covered with natural forest vegetation that has been modified by past logging and grazing, with some cleared areas at the extremities of the study area. The proposed expansion of the quarry will result in the removal of approximately 42.6 ha of native vegetation.



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Study Area and Regional Location

FIGURE 1

1.3 Koala ecology and Habitat

The Koala (*Phascolarctos cinereus*) is listed as Vulnerable on both the NSW *Biodiversity Conservation Act 2016* (BC Act) and on the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Koala has a fragmented distribution throughout eastern Australia from the inhabiting a range of eucalypt forest and woodland communities usually where preferred browse species of eucalypt occur, from north-eastern Queensland to south-eastern South Australia and to the west of the Great Dividing Range. Port Macquarie is considered one of the important population centres for Koalas (Ecotone 2013).

Koalas are fundamentally solitary animals that occupy a small home range that may overlap with other individuals. In preferred habitat female Koalas have a home range of approximately 1 hectare, whereas males have approximately 1 to 1.5 hectares, depending on their age and size. Koala home ranges will vary in size depending on the quality of the habitat and suitability, with home range size varying from less than two hectares, to several hundred hectares during breeding season (DPIE 2019). The breeding season for the Koala peaks between September and February. The young spend the first six months in the pouch and are then carried on the mothers back. At 12 months of age the young are independent, but do not reach sexual maturity until they are two years of age (DPIE 2019).

Koalas are known to use a variety of eucalyptus and non-eucalyptus species throughout NSW (DPIE 2020). A review of Koala tree use identified approximately 137 tree species in 2018, but following consultation with Koala experts, the list was refined to 123 species in the *Koala Habitat Information Base Technical Guide* (DPIE 2020). These 123 tree species were categorised into nine distinct regions, according to feed tree preferences in each region. Port Macquarie (and the subject site at Sancrox) is located within the North Coast region and contains a total of 42 Koala use tree species (DPIE 2020).

.

2 Koala assessment methodology

2.1 Overall assessment methodology

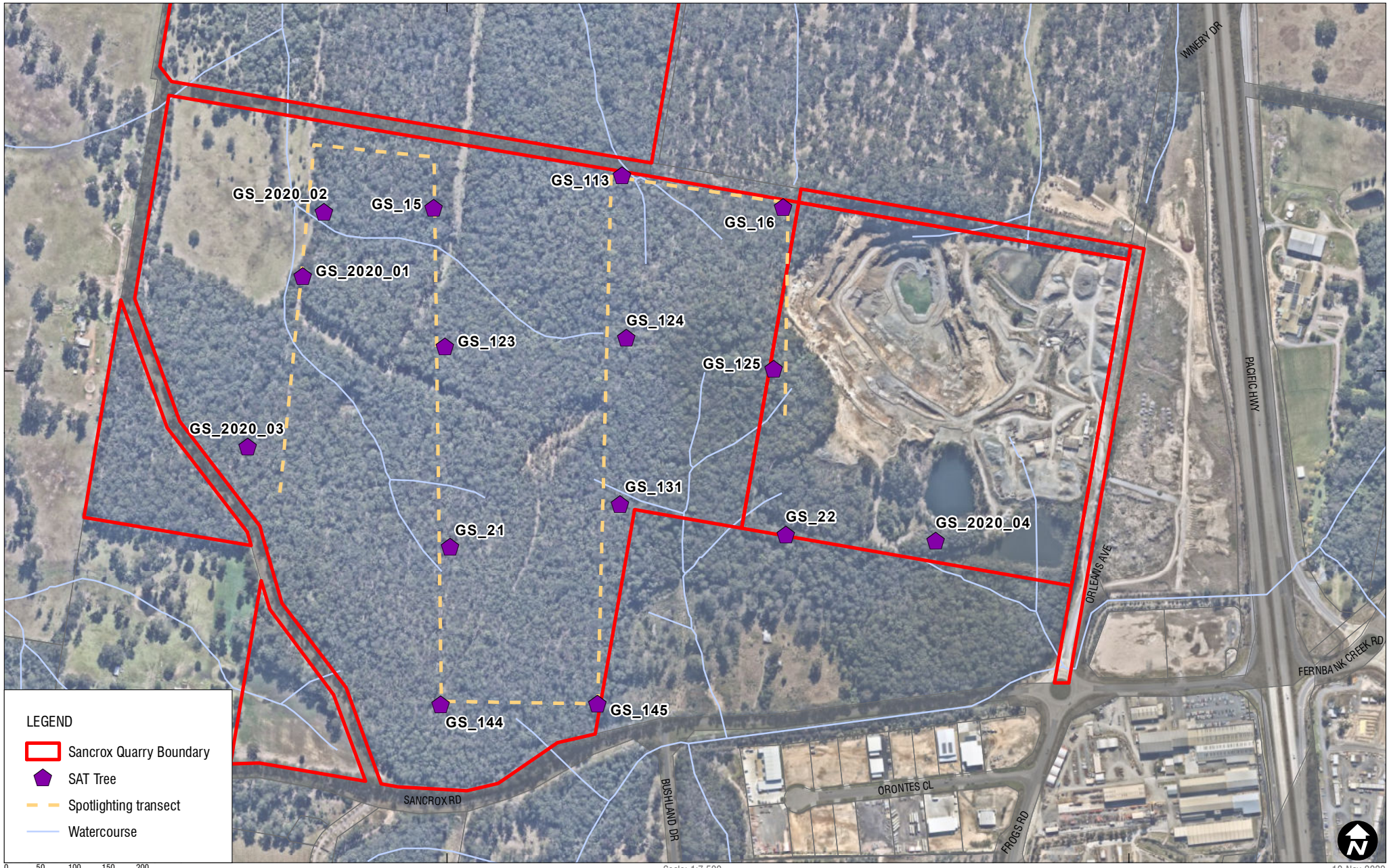
Field assessments were undertaken using RGb-SAT (Regularised Grid-based Spot Assessment Technique) underpinned by the protocols of Phillips and Callaghan (2011) and two consecutive nights of spotlight searches along a walking transect. Field transects were carried out by Biolink ecologists Dr. Amanda Lane and Kristen Wallis and SLR Ecologist Caitlin Cross.

Field survey assessments were undertaken across the study area on the 12-13 October 2020, during which time 15 SAT sites were assessed and a 3 km walking spotlight transect was undertaken on two consecutive nights.

2.2 SAT survey

The study area was initially overlain with a 250 m grid and aerial imagery to identify potential sampling points that are spatially independent and occur within an area of mapped eucalypt woodland/forest. Eleven of these 15 sites were previously surveyed by Biolink (2011). Coordinates (UTM) were determined for each corresponding sampling point and uploaded into a hand-held GPS to enable location in the field. Once a sampling point was located, Koala activity was measured using the SAT protocols of Phillips and Callaghan (2011). Koala activity (measured as a percentage, %) was determined based on the number of trees with Koala faecal pellets within a prescribed search area of 1 m around the base of a tree that has a stem diameter greater than 100 mm at breast height (DBH), accounting for the total number of trees sampled, up to a maximum of 30. By way of example, three positive trees (ie trees with scats present within 1 m of the base) out of 30 would yield a Koala activity score of 10 %.

The distribution of surveyed field sites (ie SAT sites) is illustrated in **Figure 2** and scanned copies of survey data sheets are provided in **Appendix A**.



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Koala Survey Locations

FIGURE 2

2.3 Nocturnal (spotlighting) surveys

Spotlighting was undertaken from 7:30 pm to 10:30 pm on 12 and 13 October 2020. Nocturnal surveys consisted of spotlighting transects that were designed to sample the variety of vegetation types and hence Koala habitat types across the site. A series of walked traverses was completed across the site over two nights, with the same transect alignment repeated on the second night. The transect alignment is shown in **Figure 2.** The length of the transect totalled approximately 3 km; the precise location of the centreline of the transect was subject to minor variations based on local topography.

2.4 Spatial modelling

Habitat utilisation / naïve occupancy was calculated by Biolink according to the number of active sites (ie SAT sites) divided by the total number of sites. This value is reported with a standard error (SE).

Koala activity data from all SAT sites were interpolated using regularised, thin-plate splining techniques using the spatial analyst extension in ArcGIS 10.5, performed by Biolink. Output from the splining process was used to produce an activity contour model to delineate areas occupied by resident Koala populations by identifying contours greater than 10 % indicating significant activity thresholds of Phillips and Callaghan (2011) as detailed in **Table 1**. Lower activity contours were included in the activity model to assist with interpretation of connectivity. This process produces a meta-population model (or contour map) that delineates important 'source' areas supporting established resident Koala populations. These modelled areas of significant Koala activity tend to encapsulate most contemporary Koala records including 100 % of breeding families (Biolink 2007).

Given the occurrence of Preferred Koala Food Trees (PKFTs) such as grey gum across the study area, Koala activity was interpreted in the terms of the East Coast (low) population density level of utilisation as defined by Phillips and Callaghan (2011).

Table 1 Categorisations of Koala activity[#]

Activity category	Low use	Medium (normal) use	High use
East Coast (low)	<9.97%	≥ 9.97% but ≤ 12.59%	>12.59%

Based on use of mean activity level ± 99% confidence intervals. Activity levels in the medium (normal) and High use range for East Coast (low) activity categories indicates occupancy by resident koala populations

3 Survey Results

3.1 Previous Surveys

Several surveys targeting the Koala have been completed on the Sancrox site and also within the wider Port Macquarie Hastings local government area over the last 10 years. The ecological assessment completed for the *Greater Sancrox Structure Plan* (Biolink 2011) identified two small areas of significant Koala activity, of which both are located within the site. Although no Koalas were recorded on the site, the recording of scats provided enough data to model the distribution of core Koala habitat. Two populations of less than 10 to 15 individuals were predicted to utilise the bushland within and around the site and were considered to be restricted to these areas by the Pacific Highway to the east and extensive clearing to the west and north. Accordingly, the Sancrox area was identified and mapped as an area of 'generational persistence', meaning that records extend beyond the lifespan of individual animals (Biolink, 2011).

Koala habitat mapping conducted by Biolink in 2013 identified the Port Macquarie-Hastings local government area in which the Sancrox Quarry is located as an area of high generational persistence and a high likelihood of Koalas occurring within the area (OEH 2014).

In a previous survey for Koalas on the Sancrox Quarry site, Ecotone (2013) recorded evidence of Koala activity in the form of scats and scratches on tree bark. However, no Koalas were sighted and no males were heard calling. Ecotone (2013) state that the evidence for the presence of Koalas (ie scratches on bark and scats) was not recent and was likely to be several months old. On this basis, Ecotone conclude that Koalas still utilise the habitats within the site for dispersal between other areas of habitat in the locality.

Similarly, SLR recorded evidence of Koala activity during field surveys in November 2015, being a small number of older scats and possible tree scratches (see SLR 2019). However, despite comprehensive searches for Koalas using visual inspection of feed trees, listening for male calls, spotlighting and the Spot Assessment Technique (10 SAT sites in total), no evidence via sightings or calls was recorded. The results of the SAT assessment indicated that Koala activity on the site at the time was 'Low'.

3.2 Koala Habitat

Fir the current survey, SAT surveys were conducted at 15 sites comprising of a total of 16 tree species during the surveys (**Table 2**). Of these, 15 species are listed as Koala feed trees (DPIE 2020). The full list of Koala feed trees for the North Coast Management Area, which incorporates the Sancrox locality, is listed in **Appendix B**.

Table 2 Tree species recorded as part of the SAT surveys within Sancrox Quarry

Scientific name	Common name	Koala use trees[#]
Allocasuarina torulosa	Forest Oak	Yes
Corymbia intermedia	Pink Bloodwood	Yes
Corymbia maculata	Spotted Gum	Yes
Eucalyptus sp.		Yes
Eucalyptus acmenoides	White Mahogany	Yes
Eucalyptus carnea	Thick-leaved Mahogany	Yes
Eucalyptus crebra	Narrow-leaved Ironbark	Yes

Scientific name	Common name	Koala use trees[#]
Eucalyptus glaucina	Slaty Red Gum	Yes
Eucalyptus globoidea	White Stringybark	Yes
Eucalyptus microcorys	Tallowwood	Yes
Eucalyptus pilularis	Blackbutt	Yes
Eucalyptus propinqua	Small-fruited Grey Gum	Yes
Eucalyptus robusta	Swamp Mahogany	Yes
Eucalyptus tereticornis	Forest Red Gum	Yes
Lophostemon confertus	Brush box	No
Melaleuca sp.		Yes

Koala use trees as defined by DPIE (2020)

Vegetation mapping conducted as part of the BAR indicates that the forested parts of the site are classified into three plant community types (PCTs), as listed in **Table 3**.

Table 3 Plant Community Types (PCTs) mapped within the study area

PCT Code	PCT Name	TEC	Area (ha)
686	Blackbutt - Pink Bloodwood shrubby open forest of the coastal lowlands of the NSW North Coast Bioregion	Yes	0.6
1215	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	No	11.0
1262	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	31.0
	Total Native Vegetation		**42.6**

Koala feed trees are present in all three PCTs and are distributed widely across the site. According to DPIE (2020), and based on the results of the BAR surveys and the current Koala survey, the site contains 13 Koala feed trees, as follows:

- Spotted Gum *Corymbia maculata*;
- Pink Bloodwood *Corymbia intermedia*;
- Small-fruited Grey Gum *Eucalyptus propinqua*;
- Blackbutt *Eucalyptus pilularis*;
- Tallowwood *Eucalyptus microcorys*;
- Thick-leaved Mahogany *Eucalyptus carnea;*
- White Stringybark *Eucalyptus globoidea*;
- Grey Ironbark *Eucalyptus siderophloia*;
- Flooded Gum *Eucalyptus grandis* (in offset site);
- Broad-leaved Paperbark *Melaleuca quinquenervia*;
- Forest Red Gum *Eucalyptus tereticornis* (in offset site);

- Narrow-leaved Red Gum *Eucalyptus seeana* (in offset site); and
- Forest Oak *Allocasuarina torulosa*.

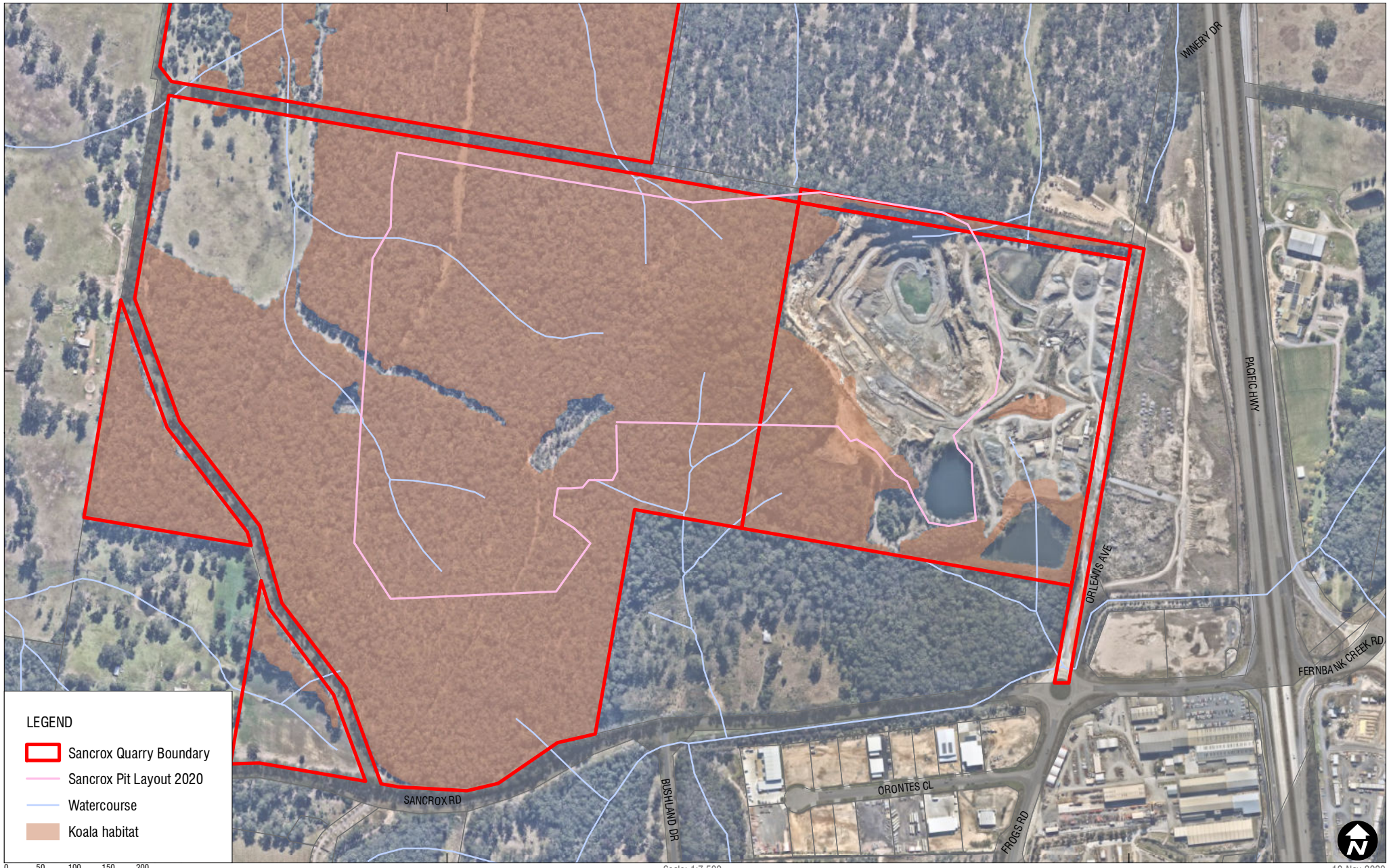
It is also noted that Koalas have been recorded feeding on Swamp Oak *Casuarina glauca* (which is more common in the offset site) at Bonville (G Leonard *pers. comm.* 2016), although Swamp Oak is not generally recognised as a Koala feed tree.

Given the widespread presence of Koala feed trees across the site, all PCTs mapped (in the BAR) as occurring on the site, comprising a total area of 42.6 hectares, are considered to constitute Koala habitat, in accordance with the methods for identification of species credits in the FBA. Consequently, a map of Koala habitat has been prepared by combining the PCTs mapped across the site, as shown **Figure 3**.

3.3 Koala Activity

Evidence of Koalas in the form of diagnostic faecal pellets was recorded at eight of the 15 sampled SAT sites (**Figure 4**) resulting in a habitat utilisation / naïve occupancy estimate of 53 % $\pm$ 13 % (SE) of the available habitat. Eight SAT sites yielded evidence of Koalas with activity levels ranging from 3.33% - 33.33% (**Table 4**). Three sites returned 'high' activity levels (13.33% - 33.33%) and one site returned 'medium' activity level (10.00%) in accordance with Phillips and Callaghan (2011) (**Table 1**). Four sites yielded 'low' activity levels (3.33% - 6.67%) and the remaining sites returned no activity levels.

Koala activity data collected from the current field survey was modelled by Biolink to produce a set of activity contours, which are displayed on **Figure 5**. The Koala activity contours show an activity cell adjoining the western edge of the quarry, reaching both the northern and southern boundary of the site, as well as another cell in the western portion of the site, centred around sampling point GS_2021 (see **Figure 2**). These cells indicate high use areas within Koala home ranges, which may extend beyond the bounds of the study area.



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Koala Habitat within Sancrox Quarry

FIGURE 3

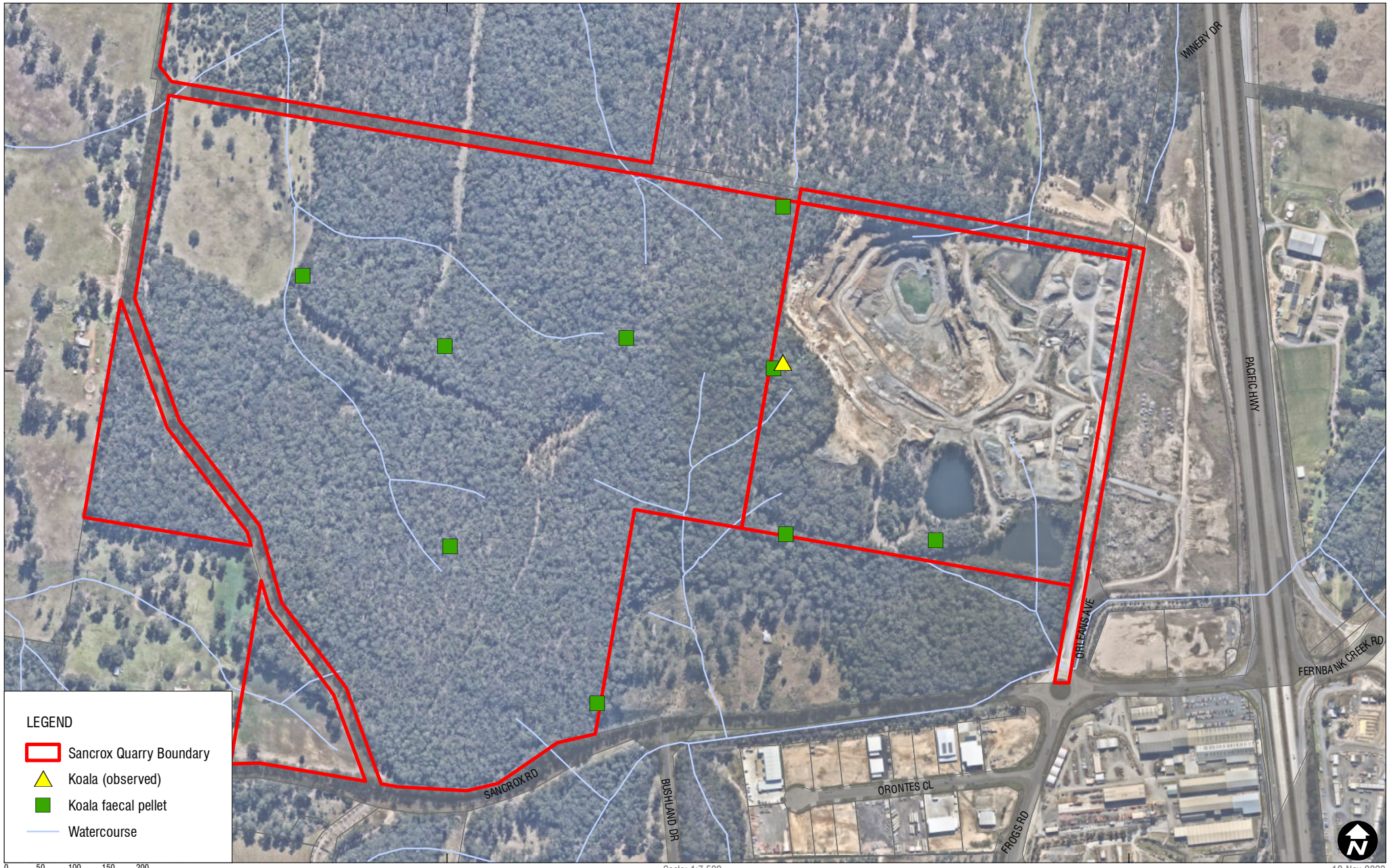
Table 4 Koala activity level amongst SAT sites

Site code	Total number of trees	Activity (as %)	Activity level	Easting	Northing
GS_113	30	0.00	Nil	482257	6522287
GS_123	30	10.00	Medium	481997	6522036
GS_124	31	6.45	Low	482263	6522048
GS_125	30	33.33	High	482479	6522003
GS_131	30	0.00	Nil	482254	6521805
GS_144	30	0.00	Nil	481991	6521511
GS_145	30	3.33	Low	482221	6521512
GS_15	30	0.00	Nil	481981	6522239
GS_16	30	13.33	High	482493	6522240
GS_2020_01	30	26.67	High	481789	6522139
GS_2020_02	30	0.00	Nil	481820	6522233
GS_2020_03	30	0.00	Nil	481708	6521889
GS_2020_04	30	3.33	Low	482717	6521751
GS_21	30	0.00	Nil	482005	6521742
GS_22	30	6.67	Low	482497	6521760

3.4 Koala Sightings

One Koala was sighted during nocturnal (spotlighting) surveys and the location of the sighting is shown in **Figure 4**. The young adult Koala sighted was found in a Spotted Gum *Corymbia maculata* approximately 50 m west of the existing pit wall.

No Koalas were sighted in previous surveys conducted by SLR in 2015 or by Ecotone in 2013.



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Locations of positive SAT sites and Koala sighting

FIGURE 4

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Koala activity contours

FIGURE 5

4 Discussion and Conclusion

The proposed expansion of the Sancrox quarry will remove approximately 42.6 ha of Koala habitat of the lands comprising of the Sancrox Quarry. Previous survey data conducted by SLR in 2015 and Ecotone in 2013 indicated that Koala activity levels on site were 'Low'. The ecological analysis of Koala activity levels during the current survey identified two Koala activity cells adjoining the western edge of the quarry, reaching both the northern and southern boundary of the site, as well as another cell in the western portion of the site.

Survey data of direct and indirect evidence of the site as defined by Phillips and Callaghan (2011) identified medium and high use SAT sites within the activity cells indicating the presence of one or more resident Koalas within the Sancrox quarry. Additionally, the site has previously been mapped as an area of 'generational persistence' by Port Macquarie Council (OEH 2014). Historical modelling indicates that two populations of less than 10 to 15 individuals have utilised the Sancrox locality; however, these populations are restricted to these areas by the Pacific Highway to the east and extensive clearing to the west and north (PMHC 2015). The current survey results combined with areas of modelled high Koala activity and widespread presence of several Koala feed trees across the site indicates that the forested parts of the site all qualify as Koala habitat within the meaning of the FBA.

The proposed expansion of the Sancrox quarry will require the removal of around 42 ha of Koala habitat and may have the potential to negatively impact on local Koala movements and the home ranges of resident Koalas within the Sancrox study area. The site is considered to provide habitat for Koalas, with the presence of one or more resident Koalas within the study area. On the basis of the current findings and following Section 6 of the FBA, a 'species polygon' is required to be drawn around all Koala habitat within the site and species credits calculated.

5 References

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APPENDIX A

Koala SAT Field Sheets

PROJECT: Sancrox Quarry Koala Surveys 2020 **FULL SAT DATA SHEET**

SAT No: GS 145 **Staff:** Caitlin (SLR), Amanda, Kirsty **Date:** 12 / 10/2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA 94	5	6	4	8	2	2	2	1	6	5	2	1	5	1	2	3

Elevation	Aspect								Slope		
18	N	NE	E	SE	(S)	SW	W	NW	(0 - 10)	10 - 30	>30

SAT DATA

	Tree sp	DBH (mm)	K	FP
1 (CT)	E. Pro	288	—	
2	E. Pro	244	—	
3	E Cor	407	—	
4	E Pro	261	—	
5	E Pro	232	—	
6	E. Cor	522	—	
7	E. Pro	346	—	
8	E. Cor	124	—	
9	Allo. cos	128	—	
10	Ironbark	460	—	
11	E. Cor	271	—	
12	E. Cor	244	—	
13	E. Inc	194	—	
14	E. Glo	348	—	
15	E. Glo	263	—	
16	E. Mic	133	—	
17	E. Mic	~~150~~ 550		X
18	E. Glo	400	—	
19	E. Glo	281	—	
20	E Pro	330	—	
21	E Glo	375	—	
22	E. Mic	255	—	
23	Ironbark	256	—	
24	E. Prop	330	—	
25	E. Pro	403	—	
26	E. Inc	218	—	
27	E. Glo	185	—	
28	E. Mic	295	—	
29	E Glo	468	—	
30	E. Mic	410	—	

1. **Soil Landscape:** _____

2. **SAT Criteria:** 1 2 (3)

3. **Age of pellets:** (Old) Mixed Fresh

4. **A/Level:** 1 / 30 = 3.3 %

5. **Mean % groundcover in search area:**
< 30% (30 – 70%) >70%

6. **Comments:**

7. **No Koalas within 25m of CT:** N/A

Checked by: Kirsty **Date:** 19/10/20 **Entered by:** Kirsty **Date:** 19/10/20

DATA Checklist: Database ☑ Scanned ☑ Filed ☐

PROJECT: Sancrox Quarry Koala Surveys 2020 **FULL SAT DATA SHEET**

SAT No: __GS 144___ **Staff:** Caitlin (SLR) Amanda Kirsty **Date:** 12 / 10 /2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA 94	5	6	4	8	1	9	9	1	6	5	2	1	5	1	1	3

Elevation	Aspect								Slope		
35	N	NE	E	SE	S	SW	W	(NW)	(0 - 10)	10 - 30	>30

SAT DATA

	Tree sp	DBH (mm)	K	FP
1 (CT)	E. Glo	290		
2	E. Glo	275		
3	E. Glo	193		
4	E. Mic	145		
5	E. Glo	490		
6	E. Glo	321		
7	E. Glo	385		
8	E. Glo	175		
9	E. Glo	290		
10	E. Pro	298		
11	E. Glo	369		
12	E. Pro	255		
13	Ironbark	300		
14	E. Glo	513		
15	E. Glo	280		
16	E. Glo	436		
17	E. Intermedia	435		
18	E. Glo	267		
19	E. car	290		
20	E. Mic	217		
21	E. Pro	275		
22	Ironbark	243		
23	E. Glo	360		
24	E. Glo	273		
25	E. Glo	169		
26	E. Pro	360		
27	E. car	117		
28	E. Glo	338		
29	E Intermed	347		
30	E. Int	165		

1. Soil Landscape: _____

2. SAT Criteria: 1 2 (3)

3. Age of pellets: Old Mixed Fresh

4. A/Level: __0/30 = _0._ %

5. Mean % groundcover in search area:

< 30% (30 – 70%) >70%

6. Comments:

- Possum Scats present
- Large Macropod Scats present

7. No Koalas within 25m of CT: N/A

Checked by: Kirsty **Date:** 19/10/20 **Entered by:** Kirsty **Date:** 12/10/20

DATA Checklist: Database ☑ Scanned ☑ Filed ☐

PROJECT: Sancrox Quarry Koala Surveys 2020 **FULL SAT DATA SHEET**

SAT No: GS 21 **Staff:** Caitlin (SLR) Amanda Kirsty **Date:** 12/10/2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA 94	5	6	4	8	2	0	0	5	6	5	2	1	7	4	2	3

Elevation	Aspect								Slope		
28	(N)	NE	E	SE	S	SW	W	NW	0 - 10	(10 - 30)	>30

SAT DATA

	Tree sp	DBH (mm)	K	FP
1 (CT)	E.Glo	330		X
2	E.Glo	245		
3	E.car	350		
4	E Glo	328		
5	Ironbark	410		
6	Ironbark	508		
7	White Mahog	523		
8	White Mahogg	417		
9	E.Glo	228		
10	E.Glo	220		
11	~~C.trac~~ Cint	218		
12	E.Glo	192		
13	E.Glo	505		
14	~~C.trac~~ Cint	317		
15	E.Glo	430		
16	Gr Gum	350		X
17	E.Pio	427		
18	E Pio	190		
19	E.car	487		
20	~~C.trac~~ Cint	343		
21	Ironbark	500		
22	E.Pio	223		
23	E.Glo	135		
24	E.Glo	198		
25	~~E.tereticornis~~ Cint	122.		
26	~~E.tereticornis~~ Cint	135		
27	Ironbark	405		
28	E.Glo	200		
29	White Mahogan	304		
30	~~E.tereticornis~~ Cint	113		
	E.Pio	280		

1. **Soil Landscape:** _____

2. **SAT Criteria:** 1 2 (3)

3. **Age of pellets:** (Old) Mixed Fresh

4. **A/Level:** 2 / 30 = 6.67%

5. **Mean % groundcover in search area:**
(< 30%) 30 – 70% >70%

6. **Comments:**
Large Marsupial Scats

7. **No Koalas within 25m of CT:** N/A

Checked by: Kirsty **Date:** 19/10/20 **Entered by:** Kirsty **Date:** 12/10/20.

DATA Checklist: Database ☑ Scanned ☑ Filed ☐

PROJECT: Sancrox Quarry Koala Surveys 2020 **FULL SAT DATA SHEET**

SAT No: __GS__15__ **Staff:** Caitlin (SLR) Amanda Kirsty **Date:** 12/10 /2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA 94	5	6	4	8	1	9	8	1	6	5	2	2	2	3	9	3
Elevation	Aspect								Slope							
11	N	NE	E	SE	S	SW	W	(NW)	(0 - 10)		10 - 30		>30			

SAT DATA

	Tree sp	DBH (mm)	K	FP
1 (CT)	Grey Gum	226	—	
2	E. Glo	283	—	
3	E. Glo	387	—	
4	Swamp Mahog	600		—
5	E. Glo	398	—	
6	Cloc	240		—
7	E. Mic	604	—	
8	E. Car	400	—	
9	E. Car	180	—	
10	E. Pro	310	—	
11	E. Pa	1011 (2)	—	
12	Mel. spp	165	—	
13	Mel. Spp	161	—	
14	E. Lat	229	—	
15	E. Lat	303	—	
16	E. Mic	520	—	
17	E. Mic	312	—	
18	Ironbark	495	—	
19	E. Mic	152	—	
20	E. Mic	390	—	
21	E. Pa	286	—	
22	White Mahog	470	—	
23	Ironbark	174	—	
24	E. Mic Cint	147	—	
25	E. Cint	225	—	
26	E. Mic	245		—
27	White Mahog	326	—	
28	E. Mic	226	—	
29	White Mahog	442	—	
30	Ironbark	605	—	

1. **Soil Landscape:** _____

2. **SAT Criteria:** 1 2 (3)

3. **Age of pellets:** Old Mixed Fresh

4. **A/Level:** 0 / 30 = 0 %

5. **Mean % groundcover in search area:**
(< 30%) 30 – 70% >70%

6. **Comments:**
Brush tail Possum Scat

7. **No Koalas within 25m of CT:** N/A

Checked by: Kirsty **Date:** 19/10/20 **Entered by:** Kirsty **Date:** 12/10/20

DATA Checklist: Database ☑ Scanned ☑ Filed ☐

PROJECT: Sancrox Quarry Koala Surveys 2020 **FULL SAT DATA SHEET**

SAT No: GS 123 **Staff:** Caitlin (SLR), Amanda, Kirsty **Date:** 12 /10 /2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA 94	5	6	4	8	1	9	9	7	6	5	2	2	0	3	6	3

Elevation	Aspect								Slope		
18	N	(NE)	E	SE	S	SW	W	NW	(0 - 10)	10 - 30	>30

SAT DATA

	Tree sp	DBH (mm)	K	FP
1 (CT)	E. Glo	217	—	
2	E. cor	349	—	
3	Ironbark	384		X
4	E Glo	290	—	
5	E. Pro	260	—	
6	E. Glo	352 (2)	—	
7	E cor	380	—	
8	E Glo	198	—	
9	E cor	722 (2)		X
10	E Pro	337	—	
11	E. Pro	339	—	
12	C. int	560		X
13	E. Glo	224	—	
14	E Glo	356	—	
15	E Glo	202	—	
16	E Pro	294	—	
17	E Pro	220	—	
18	E. Pro	345 (2)	—	
19	E Pro	435	—	
20	E. Pro	403	—	
21	E. Glo	355	—	
22	E Pro	243	—	
23	C. int	227	—	
24	E Pro	162	—	
25	E Glo	241	—	
26	Ironbark	357	—	
27	E Glo	234	—	
28	E cor	410	—	
29	E. Pro	373	—	
30	E. Pro	447	—	

1. Soil Landscape: _____

2. SAT Criteria: 1 2 (3)

3. Age of pellets: (Old) Mixed Eresh

4. A/Level: 3/30 = 10._ %

5. Mean % groundcover in search area:

(< 30%) 30 – 70% >70%

6. Comments:

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7. No Koalas within 25m of CT: N/A

Checked by: Kirsty **Date:** 19/10/20 **Entered by:** Kirsty **Date:** 12/10/20

DATA Checklist: Database ☑ Scanned ☑ Filed ☐

PROJECT: Sancrox Quarry Koala Surveys 2020 **FULL SAT DATA SHEET**

SAT No: __GS-2020-02 **Staff:** Caitlin (SLE) Amanda Kirsty **Date:** 12 /10 /2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA 94	5	6	4	8	1	8	2	0	6	5	2	2	3	3	1	3

Elevation	Aspect								Slope		
8	N	NE	E	SE	S	SW	(W)	NW	(0 - 10)	10 - 30	>30

SAT DATA

	Tree sp	DBH (mm)	K	FP
1 (CT)	E.mic	530	—	
2	Ironbark	188	—	
3	Ironbark	191	—	
4	E.mic	249	—	
5	E.mic	335	—	
6	Grey Gum	232	—	
7	C Gla	128	—	
8	C Int	162	—	
9	E. Car?	592	—	
10	~~C. Mac~~ Cint	167	—	
11	E. Car	494	—	
12	Grey Gum	175	—	
13	Grey Gum	471	—	
14	C. Int	186	—	
15	~~E. Thro~~ Eglo	420	—	
16	E.mic	207	—	
17	E.mic	177	—	
18	E. Car	255	—	
19	~~E. Thro~~ Eglo	234	—	
20	~~E. Thro~~ Eglo	198	—	
21	Grey Gum	441	—	
22	E.mic	312	—	
23	~~E. Thro~~ Eglo	406	—	
24	~~C. Mac~~ Cint	163	—	
25	Ironbark	339	—	
26	E. Mic	339	—	
27	Grey Gum	430		
28	Grey Gum	343	—	
29	Ironbark	167	—	
30	~~E. Pop~~ Epro	540 (2)	—	

1. **Soil Landscape:** _____

2. **SAT Criteria:** 1 2 (3)

3. **Age of pellets:** Old Mixed Fresh

4. **A/Level:** __0__/__30__ = __0__.__ %

5. **Mean % groundcover in search area:**

(<30%) 30 – 70% >70%

6. **Comments:**

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7. **No Koalas within 25m of CT:** N/A

Checked by: Kirsty **Date:** 19/10/20 **Entered by:** Kirsty **Date:** 12/10/20

DATA Checklist: Database ☑ Scanned ☑ Filed ☐

PROJECT: Sancrox Quarry Koala Surveys 2020 **FULL SAT DATA SHEET**

SAT No: __GS__2020-01 **Staff:** Caitlin (SLR) Amanda Kirsty **Date:** 12 / 10 /2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA 94	5	6	4	8	1	7	8	9	6	5	2	2	1	3	9	3
Elevation	Aspect								Slope							
8	N	NE	E	SE	S	SW	(W)	NW	(0 - 10)		10 - 30		>30			

SAT DATA

	Tree sp	DBH (mm)	K	FP
1 (CT)	E. ter	481		—
2	Ironbark	635		X
3	C. int	509 (3)		—
4	Ironbark	552		—
5	C. int	265		—
6	C. int	479		—
7	E. Mic	240		—
8	C int	271		—
9	Mel. Spp	317 (2)		—
10	E. cor	378		—
11	C. int	442		—
12	Ironbark	130		x
13	~~C. Gla~~ Allo	239		x
14	~~C. Gla~~ Allo	125		x
15	Grey Gum	129		x
16	Ironbark	571	—	
17	E Mic	400 (3)		x
18	E. Mic	154	—	
19	E. ter	428		x
20	Ironbark	169	—	
21	C. int	485		x
22	E. Mic	511	—	
23	Ironbark	460	—	
24	Mel. Spp.	126	—	
25	Mel Spp	134	—	
26	Mel Spp.	118	—	
27	~~Cas Tit~~ Allt	174	—	
28	~~Cas Tit~~ Allt	280	—	
29	Grey Gum	220	—	
30	C int	345	—	
	C. Gla	189		

1. **Soil Landscape:** _____

2. **SAT Criteria:** 1 2 (3)

3. **Age of pellets:** (Old) Mixed Fresh

4. **A/Level:** __8/30 = 26.67%

5. **Mean % groundcover in search area:**
(< 30%) 30 – 70% >70%

6. **Comments:**
Collected Scats Bag 2020_01

7. **No Koalas within 25m of CT:** NIA

Checked by: Kirsty **Date:** 19/10/20 **Entered by:** Kirsty **Date:** 12/10/20

DATA Checklist: Database ☑ Scanned ☑ Filed ☐

PROJECT: Sancrox Quarry Koala Surveys 2020 **FULL SAT DATA SHEET**

SAT No: __GS 2020-3 **Staff:** Amanda Caitlin (SLR) Jade, Steve Kirsty **Date:** 12/10/2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA 94	5	6	4	8	1	7	0	8	6	5	2	1	3	8	9	3

Elevation	Aspect								Slope		
14	N	(NE)	E	SE	S	SW	W	NW	0 - 10	10 - 30	>30

SAT DATA

	Tree sp	DBH (mm)	K	FP
1 (CT)	410	E. mic	X	X
2	385	E. glo	X	X
3	170	ironbark	X	X
4	292	E. mic	X	X
5	388	ironbark	X	X
6	271	grey gum	X	X
7	610	E. glo	X	X
8	185	C. int	X	X
9	505(2)	E. car	X	X
10	135	C. lit	X	X
11	515	E. glo	X	X
12	330	C. int	X	X
13	295	E. mic	X	X
14	637	E glo	X	X
15	331	ironbark	X	X
16	640	E. glo	X	X
17	720	E glo	X	X
18	343	E. glo	X	X
19	690	E glo	X	X
20	180	greygum	X	X
21	428	E mic	X	X
22	188	E. mic	X	X
23	328	C. int	X	X
24	400	C. int	X	X
25	450	E. mic	X	X
26	175	C. int	X	X
27	178	C. int	X	X
28	232	C. int	X	X
29	557	E. mic	X	X
30	234	E. glo	X	X

1. **Soil Landscape:** _____

2. **SAT Criteria:** 1 2 3

3. **Age of pellets:** Old Mixed Fresh

4. **A/Level:** __0/30 = _0._ %

5. **Mean % groundcover in search area:**

< 30% 30 – 70% >70%

6. **Comments:**

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7. **No Koalas within 25m of CT:** N/A

Checked by: Kirsty **Date:** 19/10/20 **Entered by:** Kirsty **Date:** 15/10/20

DATA Checklist: Database ☑ Scanned ☑ Filed ☐

PROJECT: ~~BRANDY HILL QUARRY~~ SANCROIX QUARRY

FULL SAT DATA SHEET

SAT No: ~~BHQ~~ GS 131

Recorder: Caitlin (SLR) Amanda Kirsty

Date: 13 / 10 /2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA	~~9~~ 56	~~47~~ 6	4	8	2	2	5	4	6	5	2	1	8	0	5	3
Elevation	Aspect								Slope							
29	N	(NE)	E	SE	S	SW	W	NW	(0 - 10)		10 - 30		>30			

SAT DATA

	Tspp	DBH (mm)	K	FP
1 (CT)	E Mic	366		—
2	Ironbark	234		—
3	Alloca	110		—
4	L. Con	560 (2)		—
5	L. con	494 (2)		—
6	E. Glo	310		—
7	E Glo	212		—
8	Ironbark	362		—
9	E. Mic	334		—
10	E. Glo.	679		—
11	E. Mic	244		—
12	Ironbark	596		—
13	L. Con	153		—
14	E Glo	260		—
15	E Glo	224		—
16	E Glo	185		—
17	E. Glo	673		—
18	Ironbark	358		—
19	E Mic	387		—
20	L. Con	326		—
21	E. Mic	426		—
22	E Mic	468		—
23	E. Int	288		—
24	E. Mic	283		—
25	Ironbark	490		—
26	E. Glo	243		—
27	E Glo	115		—
28	E Glo	242		—
29	C. Int	163		—
30	E Mic	479		—

1. Soil Landscape: _____

2. SAT Criteria: 1 2 3

3. Age of pellets: Old Mixed Fresh

4. A/Level: 0 / 30 = 0. _ %

5. Mean % groundcover in search area:

(< 30%) 30 – 70% >70%

6. Comments:

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7. No Koalas within 25m of CT: N/A

Checked by: Kirsty Date: 19/10/20 Entered by: Kirsty Date: 15/10/20

DATA Checklist: Entered ☑ Scanned ☑ Filed ☐

PROJECT: ~~BRANDY HILL QUARRY~~ SAN CROOC QUARRY

FULL SAT DATA SHEET

SAT No: ~~BHQ~~ GS 124 Recorder: Caitlin (SLR) Amanda Kirsty Date: 13 /10 /2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA	~~55~~	56	4	8	2	2	6	3	6	5	2	2	0	4	8	3
Elevation	Aspect								Slope							
43	N	NE	(E)	SE	S	SW	W	NW	0 - 10		10 - 30		>30			

SAT DATA

	Tspp	DBH (mm)	K	FP
1 (CT)	E. Pro	342		X
2	Allo.cas	160	—	
3	E.Glo	530	—	
4	Allocas	135	—	
5	E. pro	332		1
6	Allocas	140	—	
7	Allocas	110	—	
8	C.int	510	—	
9	C.int	235	—	
10	E Glo	219	—	
11	E. Glo	183	—	
12	Allocas	135	—	
13	C.cit	244	—	
14	E.Pro	358	—	
15	E Pro	323	—	
16	C.cit	197	—	
17	C.cit	466		
18	C.int	255	—	
19	Allocas	167	—	
20	Allocas	214	—	
21	Allocas	177	—	
22	E.Pro	422	—	
23	C.Cit	395	—	
24	E Glo	271	—	
25	E. Glo	<20	—	
26	E. Pro	464	—	
27	Allocas	140	—	
28	C. cit	256	—	
29	Allocas	140	—	
30	Allocas	200	—	

1. **Soil Landscape:** _____

2. **SAT Criteria:** 1 2 (3)

3. **Age of pellets:** Old Mixed Fresh

4. **A/Level:** 2 / 30 = 6.6 %

5. **Mean % groundcover in search area:**

(< 30%) 30 – 70% >70%

6. **Comments:**

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7. **No Koalas within 25m of CT:** N/A

Checked by: Kirsty **Date:** 19/10/20 **Entered by:** Kirsty **Date:** 15/10/20

DATA Checklist: Entered ☑ Scanned ☑ Filed ☐

PROJECT: Sancrox Quarry Koala Surveys 2020 **FULL SAT DATA SHEET**

SAT No: GS113 **Staff:** Caitlin (SLR) Amanda Kirsty **Date:** 13 / 10 /2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA 94	5	6	4	8	2	2	5	7	6	5	2	2	2	8	7	3

Elevation	Aspect								Slope		
26	N	NE	E	SE	S	SW	(W)	NW	(0 - 10)	10 - 30	>30

SAT DATA

	Tree sp	DBH (mm)	K	FP
1 (CT)	E.Pro	274	✓	
2	E.Glo	316	✓	
3	E.Glo	776	✓	
4	L.con	101	✓	
5	E.Glo	530	✓	
6	E.Mic	303	✓	
7	C.int	263	✓	
8	E.Mic	554	✓	
9	E.Glo	575	✓	
10	L.con	176	✓	
11	E.Glo	445	✓	
12	C.int	243	✓	
13	Ironbark	600 (2)	✓	
14	E.Glo	239	✓	
15	C.int	235	✓	
16	E.Glo	180	✓	
17	E.Glo	895	✓	
18	E.Glo	340	✓	
19	E.Mic	388	✓	
20	E.Pro	417	✓	
21	E.Pro	417	✓	
22	E.Glo	620	✓	
23	Ironbark	385	✓	
24	E.Glo	522	✓	
25	Ironbark	444	✓	
26	E.Mic	270	✓	
27	E.Mic	380	✓	
28	Allo.cas	100	✓	
29	Md.sp	165	✓	
30	E.Mic	291	✓	

1. Soil Landscape: _____

2. SAT Criteria: 1 2 (3)

3. Age of pellets: Old Mixed Fresh

4. A/Level: 0 / 30 = 0.0 %

5. Mean % groundcover in search area:

< 30% (30 – 70%) >70%

6. Comments:

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7. No Koalas within 25m of CT: N/A

Checked by: Kirsty **Date:** 19/10/20 **Entered by:** Kirsty **Date:** 15/10/20.

DATA Checklist: Database ☑ Scanned ☑ Filed ☐

PROJECT: Sancrox Quarry Koala Surveys 2020 **FULL SAT DATA SHEET**

SAT No: GS 2020_04 **Staff:** Kirsty. W Caitlin (SLR) Amanda. **Date:** 13 / 10 /2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA 94	5	6	4	8	2	7	1	7	6	5	2	1	7	5	1	3

Elevation	Aspect								Slope		
26	N	NE	(E)	SE	S	SW	W	NW	(0 - 10)	10 - 30	>30

SAT DATA

	Tree sp	DBH (mm)	K	FP
1 (CT)	C. Int	299		
2	C Int	199		
3	E. Glo	160		
4	C Int	259		
5	Allo. cau	136		
6	E. Pro	279		
7	C. Int	308		
8	E. Mic	349		
9	C Int	363		
10	E. Glo	231		
11	C Pro	182		
12	Allo (c)	239		
13	E Glo	260		
14	Allo. cau	160		
15	E. Glo	205		X
16	E. Mic	190		
17	C. Car	344		
18	Ironbark	303		
19	E. Glo	558 (2)		
20	Allo. Cau	280		
21	E Glo	393		
22	E. Glo	602 (2)		
23	E. Glo	356		
24	Ironbark	517		
25	E. Glo	130		
26	E. Glo	316		
27	C. Int	218		
28	E. Glo	175		
29	C Int	475 (2)		
30	C Int	143		

1. **Soil Landscape:** _____

2. **SAT Criteria:** 1 2 (3)

3. **Age of pellets:** (Old) Mixed Fresh

4. **A/Level:** 1 / 30 = 3.33%

5. **Mean % groundcover in search area:**
(< 30%) 30 – 70% >70%

6. **Comments:**

7. **No Koalas within 25m of CT:** N/A

Checked by: Kirsty **Date:** 19/10/20 **Entered by:** Jade. K **Date:** 15/10/20

DATA Checklist: Database ☑ Scanned ☑ Filed ☐

PROJECT: Sancrox Quarry Koala Surveys 2020

FULL SAT DATA SHEET

SAT No: GS 22 **Staff:** Kirsty. W, Amanda, Caitlin (SLR) **Date:** 13/10/2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA 94	5	6	4	8	2	4	9	7	6	5	2	1	7	6	0	3

Elevation	Aspect								Slope		
31	N	NE	E	SE	S	SW	W	NW	0 - 10	10 - 30	>30

SAT DATA

	Tree sp	DBH (mm)	K	FP
1 (CT)	E.Glo	278		
2	Allo.cas	126		
3	E Glo	373		
4	C Int	215		
5	E Glo	690		
6	E.Glo	305		
7	C.Glo	216		
8	E Glo	351		
9	C.Int	400		
10	E.Cer	242		
11	E Mic	127		
12	E.Glo	353		
13	EGlo	206		
14	E Pro	382		
15	E Glo	306		
16	Allo.Cas	158		
17	E.Glo	563		x
18	C.Int	787		x
19	Ironbark	324		
20	E.Glo	294		
21	Grey Gum	465		
22	E.Car	562		
23	C.Cit	219		
24	E.Glo	105		
25	E Glo	271		
26	E Glo	431		
27	E.Mic	124		
28	Ironbark	339		
29	E.Glo	623		
30	E.Mic	368		

1. **Soil Landscape:** _____

2. **SAT Criteria:** 1 2 (3)

3. **Age of pellets:** (Old) Mixed Fresh

4. **A/Level:** 2 / 30 = 6.67%

5. **Mean % groundcover in search area:**

(< 30%) 30 – 70% >70%

6. **Comments:**

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7. **No Koalas within 25m of CT:** N/A

Checked by: Kirsty **Date:** 19/10/20 **Entered by:** Jade.K **Date:** 15/10/20

DATA Checklist: Database ☑ Scanned ☑ Filed ☐

PROJECT: Sancrox Quarry Koala Surveys 2020 **FULL SAT DATA SHEET**

SAT No: __GS_125 **Staff:** Kirsty . W, Amanda, Caitlin (SLR) **Date:** 13 /10 /2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA 94	5	6	4	8	2	4	7	9	6	5	2	2	0	0	3	3

Elevation	Aspect								Slope		
52	N	(NE)	E	SE	S	SW	W	NW	0 - 10	(10 - 30)	>30

SAT DATA

	Tree sp	DBH (mm)	K	FP
1 (CT)	C. Cit	532		—
2	Allo. con	132		—
3	C. Cit	278		—
4	E. Glo	246		—
5	C. Cit	283		—
6	L. con	387		X
7	E. Mic	399		X
8	C. Cit	352		+
9	C. Cit	255		+
10	E. Mic	462		X
11	E. Glo	240		—
12	Ironbark	393		X
13	Ironbark	205		—
14	E. Glo	277		—
15	C. Cit	271		—
16	E. Glo	233		—
17	C. Cit	370		—
18	E. Glo	167		—
19	C. Cit	321		—
20	C. Cit	220		X
21	C. Cit	222		—
22	E. Glo	190		—
23	C. Cit	284		—
24	E. Pil	593		X
25	C. Cit	235		—
26	E. Glo	339		X
27	Ironbark	423		X
28	C. Cit	142		—
29	E. Pil	526		—
30	E. mil	389		—

1. **Soil Landscape:** _____

2. **SAT Criteria:** 1 2 (3)

3. **Age of pellets:** Old Mixed (Fresh)

4. **A/Level:** 10 / 30 = 33.33%

5. **Mean % groundcover in search area:**

< 30% 30 – 70% >70%

6. **Comments:**

Next to Quarry walls
& Scats Still Glossy

7. **No Koalas within 25m of CT:** N/A

Checked by: _____ **Date:** _____ **Entered by:** Jade. K **Date:** 15/10/20

DATA Checklist: Database ☐ Scanned ☐ Filed ☐

NB Koala found near here in spotlighting transect 1

PROJECT: Sancrox Quarry Koala Surveys 2020

FULL SAT DATA SHEET

SAT No: GS16 **Staff:** Kirsty W, Amanda, Caitlin (SLR) **Date:** 13/10/2020

SITE DATA

Datum	Zone		Easting						Northing							±
GDA 94	5	6	4	8	2	4	9	3	6	5	2	2	2	4	0	3

Elevation	Aspect								Slope		
32	N	NE	(E)	SE	S	SW	W	NW	0 - 10	(10 - 30)	>30

SAT DATA

	Tree sp	DBH (mm)	K	FP
1 (CT)	E. Pro	393		
2	Allocas	194		
3	E. Pro	385		
4	E Pro	288		
5	C. Int	147		
6	Allocas	143		
7	E Glo	820		
8	E Glo	454		
9	Ironbark	220		
10	E Pil	757		
11	Allocas	175		X
12	Allocas	195		
13	E. Pil	500		
14	Allocas	177		
15	E. Mac	570		X
16	E. Pil	720		
17	C. Int	268		X
18	Allo. cas	218		
19	Allo. Cas	115		
20	All cas	145		
21	Grey Gum	367		
22	E. Glo	185		
23	E. Pro	331		
24	E. Pro	516		
25	E Pil	600		
26	E. Pro	381		
27	E. Pil	1402 (3)		X
28	E. Pil	518		
29	Ironbark	352		
30	Allocas	135		

1. **Soil Landscape:** _____

2. **SAT Criteria:** 1 2 (3)

3. **Age of pellets:** Old (Mixed) Fresh

4. **A/Level:** 4 / 30 = 13.33%

5. **Mean % groundcover in search area:**

(< 30%) 30 – 70% >70%

6. **Comments:**

7. **No Koalas within 25m of CT:** NIL

Checked by: Kirsty **Date:** 19/10/20 **Entered by:** Jade K **Date:** 15/10/20

DATA Checklist: Database ☑ Scanned ☑ Filed ☐

APPENDIX B

Koala Feed Trees for the North Coast Area

Species Name	Common Name
Allocasuarina torulosa	Forest Oak
Angophora floribunda	Rough-barked Apple
Corymbia gummifera	Red Bloodwood
Corymbia henryi	Large-leaved Spotted Gum
Corymbia intermedia	Pink Bloodwood
Corymbia maculata	Spotted Gum
Eucalyptus acmenoides	White Mahogany
Eucalyptus amplifolia	Cabbage Gum
Eucalyptus bancroftii	Orange Gum
Eucalyptus biturbinata	Grey Gum
Eucalyptus campanulata	New England Blackbutt
Eucalyptus canaliculata	Large-fruited Grey Gum
Eucalyptus carnea	Thick-leaved Mahogany
Eucalyptus crebra	Narrow-leaved Ironbark
Eucalyptus eugenioides	Narrow-leaved Stringybark
Eucalyptus fibrosa	Board-leaved Red Ironbark
Eucalyptus glaucina	Slaty Red Gum
Eucalyptus globoidea	White Stringybark
Eucalyptus grandis	Flooded Gum
Eucalyptus laevopinea	Silver-top Stringybark
Eucalyptus largeana	Craven Grey Box
Eucalyptus microcorys	Tallowwood
Eucalyptus moluccana	Grey Box
Eucalyptus nobilis	Forest Ribbon Gum
Eucalyptus pilularis	Blackbutt
Eucalyptus placita	Grey Ironbark
Eucalyptus planchoniana	Bastard Tallowwood
Eucalyptus propinqua	Small-fruited Grey Gum
Eucalyptus psammitica	Bastard White Mahogany
Eucalyptus punctata	Grey Gum
Eucalyptus resinifera	Red Mahogany
Eucalyptus robusta	Swamp Mahogany
Eucalyptus rummeryi	Steel Box
Eucalyptus saligna	Sydney Blue Gum
Eucalyptus scias	Large-fruited Red Mahogany
Eucalyptus seeana	Narrow-leaved Red Gum
Eucalyptus siderophloia	Grey ironbark
Eucalyptus signata/ Eucalyptus racemose	Scribbly gum/ Narrow-leaved Scribbly Gum

Species Name	Common Name
Eucalyptus tereticornis	Forest Red Gum
Eucalyptus tindaliae	Stringybark
Eucalyptus umbra	Bastard White Mahogany
Melaleuca quinquenervia	Board-leaved paperbark

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APPENDIX I

BioBanking Credit Reports

BioBanking Credit Calculator

Threatened species predicted on site

Proposal ID :	0107/2015/2368MP
Proposal name :	Sancrox Quarry Expansion (SSD) - Koala
Assessor name :	Jeremy Pepper
Assessor accreditation number :	0107
Tool version :	v4.0
Report created :	01/04/2021 12:59

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 type(s)
Barking Owl	Ninox connivens	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Barred Cuckoo-shrike	Coracina lineata	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

Common name	Scientific name	Vegetation type(s)
Brown Treecreeper (eastern subspecies)	Climacteris picumnus subsp. victoriae	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Bush Stone-curlew	Burhinus grallarius	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Diamond Firetail	Stagonopleura guttata	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Eastern False Pipistrelle	Falsistrellus tasmaniensis	NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Eastern Freetail-bat	Mormopterus norfolkensis	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion

Common name	Scientific name	Vegetation type(s)
Eastern Freetail-bat	Mormopterus norfolkensis	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Glossy Black-Cockatoo	Calyptorhynchus lathami	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Greater Broad-nosed Bat	Scoteanax rueppellii	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Hoary Wattled Bat	Chalinolobus nigrogriseus	NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Hooded Robin (south-eastern form)	Melanodryas cucullata subsp. cucullata	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion

Common name	Scientific name	Vegetation type(s)
Little Eagle	Hieraaetus morphnoides	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Little Lorikeet	Glossopsitta pusilla	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Long-nosed Potoroo	Potorous tridactylus	NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Masked Owl	Tyto novaehollandiae	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Powerful Owl	Ninox strenua	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion

Common name	Scientific name	Vegetation type(s)
Powerful Owl	Ninox strenua	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Scarlet Robin	Petroica boodang	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
Spotted-tailed Quoll	Dasyurus maculatus	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Square-tailed Kite	Lophoictinia isura	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Swift Parrot	Lathamus discolor	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion

Common name	Scientific name	Vegetation type(s)
Varied Sittella	Daphoenositta chrysoptera	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Yellow-bellied Glider	Petaurus australis	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Yellow-bellied Sheathtail-bat	Saccolaimus flaviventris	NR247 - Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion
		NR263 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 26/03/2021 Time: 1:10:59PM Calculator version: v4.0

Major Project details

Proposal ID:	0107/2015/2368MP
Proposal name:	Sancrox Quarry Expansion (SSD) - Koala
Proposal address:	Sancrox Road Sancrox NSW 2446
Proponent name:	Hanson Construction Materials Pty Ltd
Proponent address:	Locked Bag 5260 Parramatta NSW 2124
Proponent phone:	61 2 9354 2638
Assessor name:	Jeremy Pepper
Assessor address:	Level 3 10 Kings Road New Lambton NSW 2305
Assessor phone:	02 4037 3200
Assessor accreditation:	0107

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	11.08	505.00
Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	27.94	1,725.00
Total	39.02	2,230

Credit profiles

1. Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast, (NR263)

Number of ecosystem credits created	1,725
IBRA sub-region	Macleay Hastings - Northern Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast, (NR263) Blackbutt - Tallowwood dry grassy open forest of the central parts NSW North Coast Bioregion, (NR119) Blackbutt - Turpentine open forest of the foothills of the NSW North Coast Bioregion, (NR124) Blackbutt grassy open forest of the lower Clarence Valley of the NSW North Coast Bioregion, (NR125) Brush Box tall moist forest of the northern ranges of the NSW North Coast Bioregion, (NR144) Red Mahogany open forest of the coastal lowlands of the NSW North Coast Bioregion and northern Sydney Basin Bioregion, (NR222) Tallowwood dry grassy forest of the far northern ranges of the NSW North Coast Bioregion, (NR267)	Macleay Hastings - Northern Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

2. Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion, (NR247)

Number of ecosystem credits created	505
IBRA sub-region	Macleay Hastings - Northern Rivers

Offset options - Plant Community types	Offset options - IBRA sub-regions
Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion, (NR247)	Macleay Hastings - Northern Rivers and any IBRA subregion that adjoins the IBRA subregion in which the development occurs

Summary of species credits required

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Koala	Phascolarctos cinereus	39.02	1,015

BioBanking Credit Calculator

Ecosystem credits

Proposal ID :	0107/2015/2368MP
Proposal name :	Sancrox Quarry Expansion (SSD) - Koala
Assessor name :	Jeremy Pepper
Assessor accreditation number :	0107
Tool version :	v4.0
Report created :	26/03/2021 13:12

Assessment circle name	Landscape score	Vegetation zone name	Vegetation type name	Condition	Red flag status	Management zone name	Management zone area	Current site value	Future site value	Loss in site value	Credit required for bio diversity	Credit required for TS	TS with highest credit requirement	Average species loss	Species TG Value	Final credit requirement for management zone
Circle 1	17.00	NR247_Moderate/Good	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	Moderate/Good	Yes	MZ2	10.83	55.21	0.00	55.21	0	494	Barking Owl	100.00	3.00	494
Circle 1	17.00	NR263_Moderate/Good	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Moderate/Good	Yes	MZ3	27.10	78.00	0.00	78.00	0	1,701	Masked Owl	100.00	3.00	1,701
Circle 1	17.00	NR263_Moderate/Good_Poor	Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Moderate/Good_Poor	Yes	MZ4	0.84	32.89	0.00	32.89	0	24	Masked Owl	22.22	3.00	24
Circle 1	17.00	NR247_Moderate/Good_Poor	Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion	Moderate/Good_Poor	Yes	MZ5	0.25	51.04	0.00	51.04	0	11	Barking Owl	66.67	3.00	11

BioBanking Credit Calculator

Species credits

Proposal ID :	0107/2015/2368MP
Proposal name :	Sancrox Quarry Expansion (SSD) - Koala
Assessor name :	Jeremy Pepper
Assessor accreditation number :	0107
Tool version :	v4.0
Report created :	26/03/2021 13:12

Scientific name	Common name	Species TG value	Identified population?	Can Id. popn. be offset?	Area / number of loss	Negligible loss	Red flag status	Number of credits
Phascolarctos cinereus	Koala	2.60	No		39.02	0.00	No	1,015

BioBanking Credit Calculator

Threatened species loss summary

Proposal ID :	0107/2015/2368MP
Proposal name :	Sancrox Quarry Expansion (SSD) - Koala
Assessor name :	Jeremy Pepper
Assessor accreditation number :	0107
Tool version :	v4.0
Report created :	01/04/2021 13:00

Common name	Scientific name	Is it an identified population?	Can identified population be offset?	Loss	Units	Red flagged?
Koala	Phascolarctos cinereus	No		39.02	ha	No

BioBanking Credit Calculator

Threatened species requiring survey

Proposal ID :	0107/2015/2368MP
Proposal name :	Sancrox Quarry Expansion (SSD) - Koala
Assessor name :	Jeremy Pepper
Assessor accreditation number :	0107
Tool version :	v4.0
Report created :	01/04/2021 12:58

List of species requiring survey

Common name	Scientific name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Biconvex Paperbark	Melaleuca biconvexa	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Brush-tailed Phascogale	Phascogale tapoatafa	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Common Planigale	Planigale maculata	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eastern Chestnut Mouse	Pseudomys gracilicaudatus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Eastern Pygmy-possum	Cercartetus nanus	N	N	N	N	N	N	N	N	N	N	N	N
Giant Barred Frog	Mixophyes iteratus	Y	Y	Y	Y	N	N	N	N	N	Y	Y	Y
Green-thighed Frog	Litoria brevipalmata	Y	Y	Y	N	N	N	N	N	N	Y	Y	Y
Grove's Paperbark	Melaleuca groveana	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Koala	Phascolarctos cinereus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Leafless Tongue Orchid	Cryptostylis hunteriana	Y	Y	N	N	N	N	N	N	N	N	Y	Y
Milky Silkpod	Parsonsia dorrigoensis	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
North Brother Wattle	Acacia courtii	Y	N	N	N	N	N	N	N	N	N	Y	Y
Pale-headed Snake	Hoplocephalus bitorquatus	Y	Y	Y	Y	N	N	N	N	N	Y	Y	Y
Pale-vented Bush-hen	Amaurornis moluccana	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Parma Wallaby	Macropus parma	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Common name	Scientific name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainforest Cassia	Senna acclinis	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Red-backed Button-quail	Turnix maculosus	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Regent Honeyeater	Anthochaera phrygia	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rufous Bettong	Aepyprymnus rufescens	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Rusty Plum, Plum Boxwood	Niemeyera whitei	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Scant Pomaderris	Pomaderris queenslandica	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Slender Marsdenia	Marsdenia longiloba	Y	Y	N	N	N	N	N	N	N	N	N	Y
Squirrel Glider	Petaurus norfolcensis	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Stephens' Banded Snake	Hoplocephalus stephensii	N	N	N	N	N	N	N	N	N	N	N	N
Three-toed Snake-tooth Skink	Coeranoscincus reticulatus	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	Y
Tree Guinea Flower	Hibbertia hexandra	N	N	N	N	N	N	N	N	Y	Y	Y	Y
White-eared Monarch	Carterornis leucotis	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
White-flowered Wax Plant	Cynanchum elegans	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Willawarrin Doubletail	Diuris disposita	N	N	N	N	N	N	N	N	Y	Y	N	N

BioBanking Credit Calculator

Vegetation zones requiring transects/plots survey

Proposal ID :	0107/2015/2368MP
Proposal name :	Sancrox Quarry Expansion (SSD) - Koala
Assessor name :	Jeremy Pepper
Assessor accreditation number :	0107
Tool version :	v4.0
Report created :	01/04/2021 13:00

Vegetation zone name : NR247_Moderate/Good

Vegetation type: Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion

Vegetation condition: Moderate/Good **Ancillary code:** NR247

Total area of zone (ha): 10.83 **Number of TS subzones in the zone:** 2

Minimum number of survey transects/plots required within the zone: 3

Vegetation zone name : NR263_Moderate/Good

Vegetation type: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

Vegetation condition: Moderate/Good **Ancillary code:** NR263

Total area of zone (ha): 27.10 **Number of TS subzones in the zone:** 2

Minimum number of survey transects/plots required within the zone: 4

Vegetation zone name : NR263_Moderate/Good_Poor

Vegetation type: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

Vegetation condition: Moderate/Good_Poor **Ancillary code:** NR263

Total area of zone (ha): 0.84 **Number of TS subzones in the zone:** 2

Minimum number of survey transects/plots required within the zone: 1

Vegetation zone name : NR247_Moderate/Good_Poor

Vegetation type: Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion

Vegetation condition: Moderate/Good_Poor **Ancillary code:** NR247

Total area of zone (ha): 0.25 **Number of TS subzones in the zone:** 2

Minimum number of survey transects/plots required within the zone: 1

APPENDIX J

Orchid Survey Report

15 January 2016

630.11478.00000_Sancrox orchid survey_SLR report_D2.docx

Hanson Heidelberg Cement Group
Level 10, 35 Clarence Street
SYDNEY NSW 2000

Attention: Pip Cox

Dear Pip

Sancrox Quarry Expansion
State Significant Development Application
Targeted Orchid Survey - Final Report

Please find enclosed our final report describing the methods and results of our survey for threatened orchids on the proposed Quarry Expansion Area.

Please don't hesitate to call should you wish to discuss the results or recommendations at any convenient time.

Yours sincerely

JEREMY PEPPER
Technical Discipline Manager, Ecology

Checked/ G Leonard
Authorised by: JP

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ABN 29 001 584 612

1 Introduction

Sancrox Quarry (the 'site') is located 8 kilometres (km) west of Port Macquarie, within the Port Macquarie Hastings local government area. The site compromises Lot 1 in DP 704890, Lot 1 in DP 720807, Lot 2 in DP 574308, Lot 353 in DP 754434 and an area of Crown land.

Hanson proposes to extend the life of the quarry by expanding the approved extraction boundary to facilitate the extraction and distribution of construction materials. The current annual extraction limit will be increased from 455,000 tonnes per annum (tpa) to 750,000 tpa. This will involve an expansion of the quarry footprint in a westerly direction into Lot 2, DP 574308. Construction of a concrete batching plant, asphalt plant and pug mil is also proposed. The project qualifies as State Significant Development pursuant to the NSW *Environmental Planning & Assessment Act 1979* (EP&A Act) and as such, an environmental impact statement (EIS) must accompany the project application.

In preparation for the forthcoming EIS, Hanson engaged SLR Consulting Australia Pty Ltd (SLR) to conduct threatened flora surveys, as the timing of surveys for some species is critical for their detection. In particular, there are several orchids and other cryptic plant species previously recorded in the Sancrox/Port Macquarie locality that can only be detected when in flower, and their flowering times fall generally in the August to October period. Details on these species and the survey techniques employed are provided in the following sections.

2 Scope and Aims

The primary aim of the current investigation was to conduct targeted searches for subject plant species during their known flowering periods. The specific objectives of the survey were to determine the presence (or likely occurrence) of cryptic threatened plant species within the proposed quarry expansion area and to identify recommendations for avoidance or management of threatened plants (where present).

The scope of the investigation was limited to the subject threatened plant species within those parts of the site that contain suitable habitat for these species within the timeframes specified.

3 Methods

The current investigation involved three main tasks:

- Desktop research
- Consultation
- Field survey

The methods and results of the investigation are described in detail in the following sections.

3.1 Desktop Research

Previous records of threatened species within 10 kilometres of the site were retrieved from the OEH BioNet *Atlas of NSW Wildlife* database. Threatened flora species previously recorded within 10 kilometres (km) of the site are listed in **Table 1**. A total of seven threatened species are listed, of which two species are 'cryptic', in that they must be in flower to enable detection: *Dendrobium melaleucaphilum* and *Phaius australis*.

Table 1 Threatened plant species recorded within the locality of Sancrox

Scientific Name	Common Name	NSW Status	EPBC Act	Flowering period	Habitat
Cynanchum elegans	White-flowered Wax Plant	E1,P	E	summer	Rainforest; littoral rainforest
Allocasuarina defungens	Dwarf Heath Casuarina	E1,P	E	N/A	Coastal heath
Maundia triglochinoides		V,P		spring/summer	Coastal wetlands
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V,P	V	N/A	New England Tablelands
Melaleuca biconvexa	Biconvex Paperbark	V,P	V	N/A	Swampy ground; swamp forest
Dendrobium melaleucaphilum	Spider Orchid	E1,P,2		July – October	Swampy ground; swamp forest; Melaleuca swamp (esp. *M. styphelioides*)
Phaius australis	Southern Swamp Orchid	E1,P,2	E	September – October	Swampy ground; swamp forest; Melaleuca swamp

A copy of the full BioNet search results for threatened species within 10 kilometres of the site is attached in **Appendix A**.

Additionally, analysis of regional vegetation mapping data indicated that the site contained potential habitat for *Melaleuca biconvexa* and *Cynanchum elegans*, although these two species can be detected without flowering parts and therefore at any time of year. These species, along with the orchids *Dendrobium melaleucaphilum* and *Phaius australis*, were the 'subject species' for the investigation. The flowering periods for both orchid species overlap and are generally between August and October. Targeted surveys were therefore required before the end of October to allow detection of these orchid species and address recommended survey guidelines (Bishop 2000, Jones 2000, DoE 2013).

Conversely, the site does not provide suitable habitat for *Allocasuarina defungens*, *Maundia triglochinoides* or *Eucalyptus nicholii*.

3.2 Consultation (Reference Sites)

As part of the desktop research phase, SLR investigated potential 'reference sites' for the two orchid species, in order to determine the current flowering status and therefore assist in their detection on the site. SLR contacted the NSW Office of Environment and Heritage (OEH) Coffs harbour office and Tinonee Native Orchid Nursery. OEH were able to advise on the flowering status of a local population of *D. melaleucaphilum* in the Mid-north Coast region. An OEH officer inspected a known location of *D. melaleucaphilum* and advised that, as of 16 October, the population had already flowered and no flowering parts remained. The OEH advice (D Young, OEH, email dated 16 October 2015) is provided below:

> *"An officer from the OEH visited two sites west of Urunga this morning where Dendrobium melaleucaphilum is known to occur. Each site contains a mix of both D. melaleucaphilum and D. tetragonum. The officer advised that at each site, a small proportion of plants had already flowered for this year (maybe about 5-10% of plants). The officer was unable to tell if it had been D. melaleucaphilum, D. tetragonum or both species that had flowered - the flowers were too old and shrivelled to tell (see attached)."*

OEH were not in a position to offer advice on reference sites for *P. australis*.

Contact was made with a Tinonee Native Orchids, a local nursery known for propagating local (and rare) native orchid species. Potted specimens of *P. australis* and other *Phaius* species were inspected on 16 October 2015 (the day of the survey) and were observed to be in flower in the nursery. Potted specimens of *D. melaleucaphilum* and the closely related *D. tetragonum* were observed to have already flowered.

3.3 Field Survey

The field survey was completed by Jeremy Pepper, Principal Ecologist (SLR) and Pip Cox, Environmental Scientist (Hanson) on 16 October 2015. The survey involved walked transects through areas of potential habitat for the subject plant species, according to the random meander technique (Cropper 1993). A total of 14 person hours were employed in the targeted searches over the course of one day. The random meander transects are mapped in **Figure 1**.

4 Results

4.1 Species Profiles

4.1.1 Spider Orchid *Dendrobium melaleucaphilum*

The Spider Orchid *D. melaleucaphilum* (Family Orchidaceae) is an orchid which grows on other plants (ie epiphytic) and sometimes on rocks (ie epilithic) and occurs in coastal districts and nearby ranges, extending from Queensland to its southern distributional limit in the lower Blue Mountains in New South Wales (NSW). In NSW, it is currently known from seven recent collections (OEH 2012). Stems are spreading to drooping, thin and wiry in the basal half, succulent, swollen and square in cross section in the upper half, tapering towards the tip, rooting only at the base. Leaves are spreading to erect, elliptic, 4.5–9 cm long, 15–25 mm wide, conduplicate, acuminate, thin and smooth. Inflorescences are 0.7–4 cm long and 2–8-flowered. Sepals and lateral petals are green to deep dull yellow with reddish margins or other markings; dorsal sepals are 38–60 mm long, 2–5 mm wide. The labellum is cream with reddish striations, 10–16 mm long and 7–9 mm wide (PlantNET 2015a).

This species grows frequently as an arboreal epiphyte of Prickly-leaved Paperbark *Melaleuca styphelioides*, less commonly on rainforest trees or on rocks. Flowering occurs between July and October. It is listed as 'endangered' under the NSW *Threatened Species Conservation Act 1995* (TSC Act), but is not listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In terms of identification and morphology, *D. melaleucaphilum* is very similar to the closely related Tree Spider Orchid *D. tetragonum*, which has shorter dorsal sepals (19 – 30 mm long) and shorter labellum (up to 10 mm long). *D. melaleucaphilum* was previously known as the 'large-flowered paperbark form' of *D. tetragonum* (PlantNET 2015a). Hence, these two species cannot, strictly speaking, be distinguished unless in flower.

4.1.2 Southern Swamp-orchid *Phaius australis*

The Southern Swamp-orchid *Phaius australis* (Family Orchidaceae) is a terrestrial (ground dwelling) orchid and produces the largest flowers of any Australian orchid (TSSC 2014). Each plant has 4–8 large, pleated leaves and 1–2 flower stalks. The leaves are long (approx. 70 cm) and narrow, in relation to width (3–10 cm wide). The flowers are red-brown with yellow veins inside the flower and grow in spikes on stalks that are 70–110 cm long (TSSC 2014).

P. australis grows in *Melaleuca quinquenervia* swamps and in sclerophyll forest, on the coast, at or near sea level (PlantNET 2015b). It has been reported north from Lake Cathie, but chiefly north from the Evans Head district (PlantNET 2015b). OEH (2014) notes that the species "Occurs in Queensland and north-east NSW as far south as Coffs Harbour". Historically, it extended farther south, to Port Macquarie". On this basis, the site at Sancrox is outside of the range limit of this species.

4.2 Survey Results

Survey results are listed in **Table 2**. A total of two orchid specimens were recorded during the survey, as follows:

- One specimen of Climbing Orchid *Erythrorchis cassythoides* was recorded on the northeastern portion of the site
- One specimen of a Spider Orchid *Dendrobium* sp. was recorded growing on the trunk of a Prickly-leaved Paperbark *Melaleuca styphelioides* (see **Photo 1**) located on the western margin of the quarry expansion area. The specimen is likely to be the threatened species *D. melaleucaphilum* (for reasons outlined below) but could also possibly be the closely related *D. tetragonum*.

The locations of the orchid records are displayed in **Figure 2**.

Table 2 Threatened plant survey results

Common Name	Species Name	TSC Act Status	EPBC Act	No. Stems
Climbing Orchid	*Erythrorchis cassythoides*	(not listed)	(not listed)	1
Spider Orchid	*Dendrobium* (?)* *melaleucaphilum*	E		1

* Identification to species level not possible until next flowering period.

No other threatened plant species were recorded during the survey. Notably, no evidence for the Southern Swamp-orchid *P australis* was recorded during the survey, despite the presence of 'marginal' habitat (in very restricted locations) and the timing of the survey during the flowering period for this orchid species. The quarry expansion area does not contain the primary habitat type being "*Melaleuca quinquenervia* swamps", for this species. There are, however, small stands of Flax-leaved Paperbark *Melaleuca linariifolia* occurring as a mid-canopy layer in small stands of mixed eucalypt forest in the far south of the site and in the far west of the site. These areas, whilst not ideal habitat for *P. australis*, were searched thoroughly during the survey and no individuals of this species were recorded.

The identity of the *Dendrobium* remains uncertain as the specimen recorded was not in flower and *D. melaleucaphilum* cannot be distinguished from *D. tetragonum* unless in flower. A positive identification of the *Dendrobium* specimen will not be possible until the next flowering period, which is likely to be July-August 2016. However, it is highly likely that the specimen is *D. melaleucaphilum*, rather than the closely related *D. tetragonum* given that:

- the specimen was recorded growing on *Melaleuca styphelioides*, the most common host species for *D. melaleucaphilum*, rather than a rainforest tree (the preferred habitat for *D. tetragonum*)
- the stems aren't pendulous (as with *D. tetragonum*)
- the site is not particularly shady (the location of the record is at the edge of a forest stand, with exposure to western sun)

Accordingly, future site planning and impact assessments for the EIS should be conducted on the assumption that the specimen is the threatened species *D. melaleucaphilum*, until such time as the specimen can be confidently identified to species level.

5 Discussion and Recommendations

Two orchid species were recorded during the current investigation. Of these, one specimen of an epiphytic *Dendrobium* orchid was recorded on an individual *Melaleuca styphelioides* near the western edge of the proposed quarry footprint. Until a positive identification can be made, it is recommended that the specimen be treated as the threatened species *D. melaleucaphilum*, which is listed as endangered in NSW under the TSC Act.

No other threatened plant species, notably *Melaleuca biconvexa* or *Cynanchum elegans*, or any other threatened plants previously recorded within the locality of the site, were recorded.

Further targeted surveys for threatened orchids are recommended during the known flowering period of *D. melaleucaphilum* (being approximately July-September). In this regard, confirmation of flowering of *D. melaleucaphilum* at a local reference population should be obtained from OEH and/or local nurseries, then inspection of the *Dendrobium* specimen recorded on the site should be conducted promptly to confirm flowering of the individual and then confirm species identity. To assist in identification, we recommend that high resolution photographs of the flowering parts and stems be taken and sent to the NSW Herbarium of the Royal Botanic Gardens, Sydney, for confirmation. No voucher samples (e.g. of flowering parts) should be physically removed from the plant, given its potential conservation status under the TSC Act and given the presence of only one individual on the site.

Additionally, opportunistic searches for threatened orchids should be conducted as part of any future ecological surveys within the proposed quarry expansion area as part of the investigation for the EIS.

Photo 1 Specimen of *Dendrobium* (?) *melaleucaphilum* recorded in western portion of site

6 References

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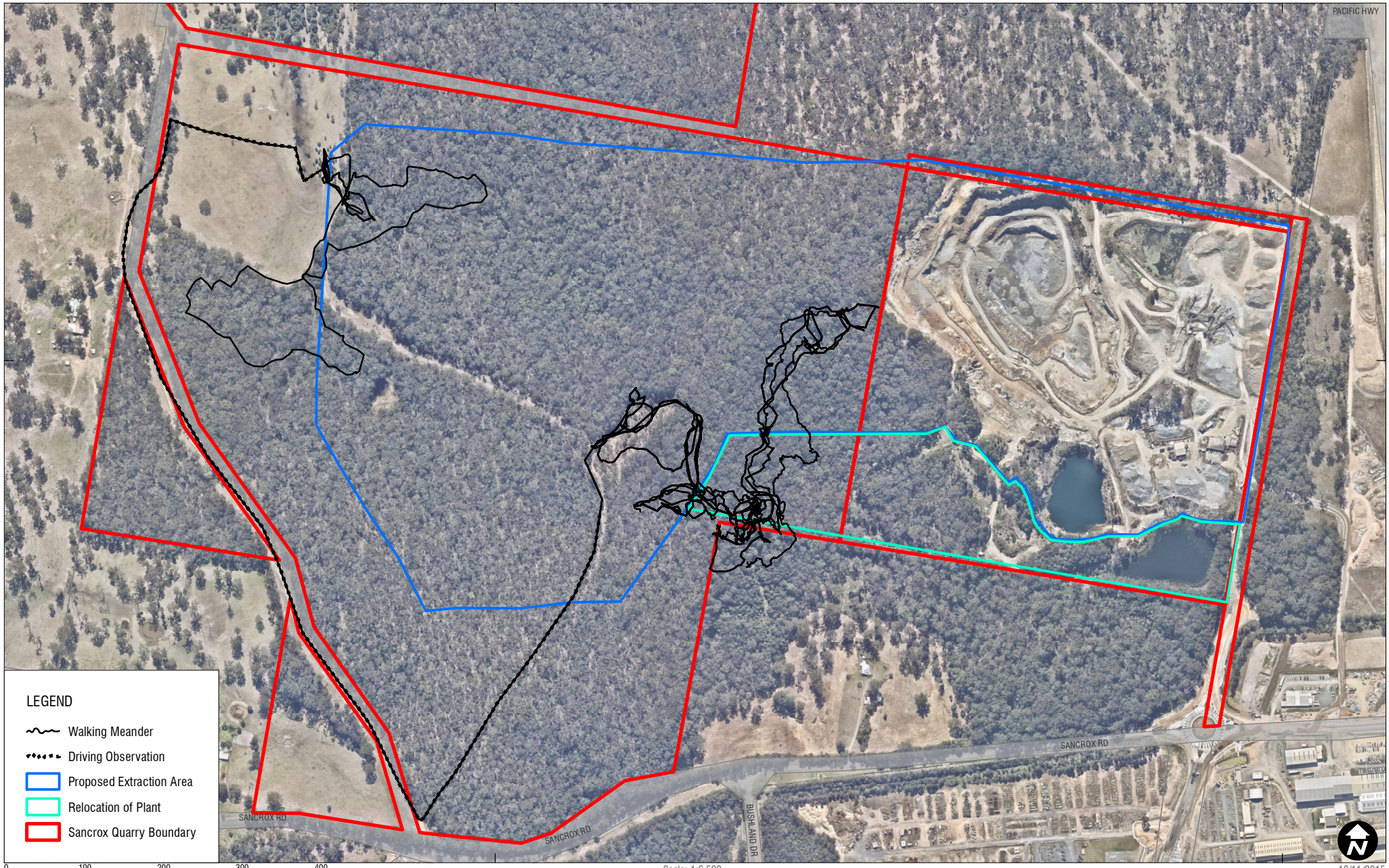

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SLR

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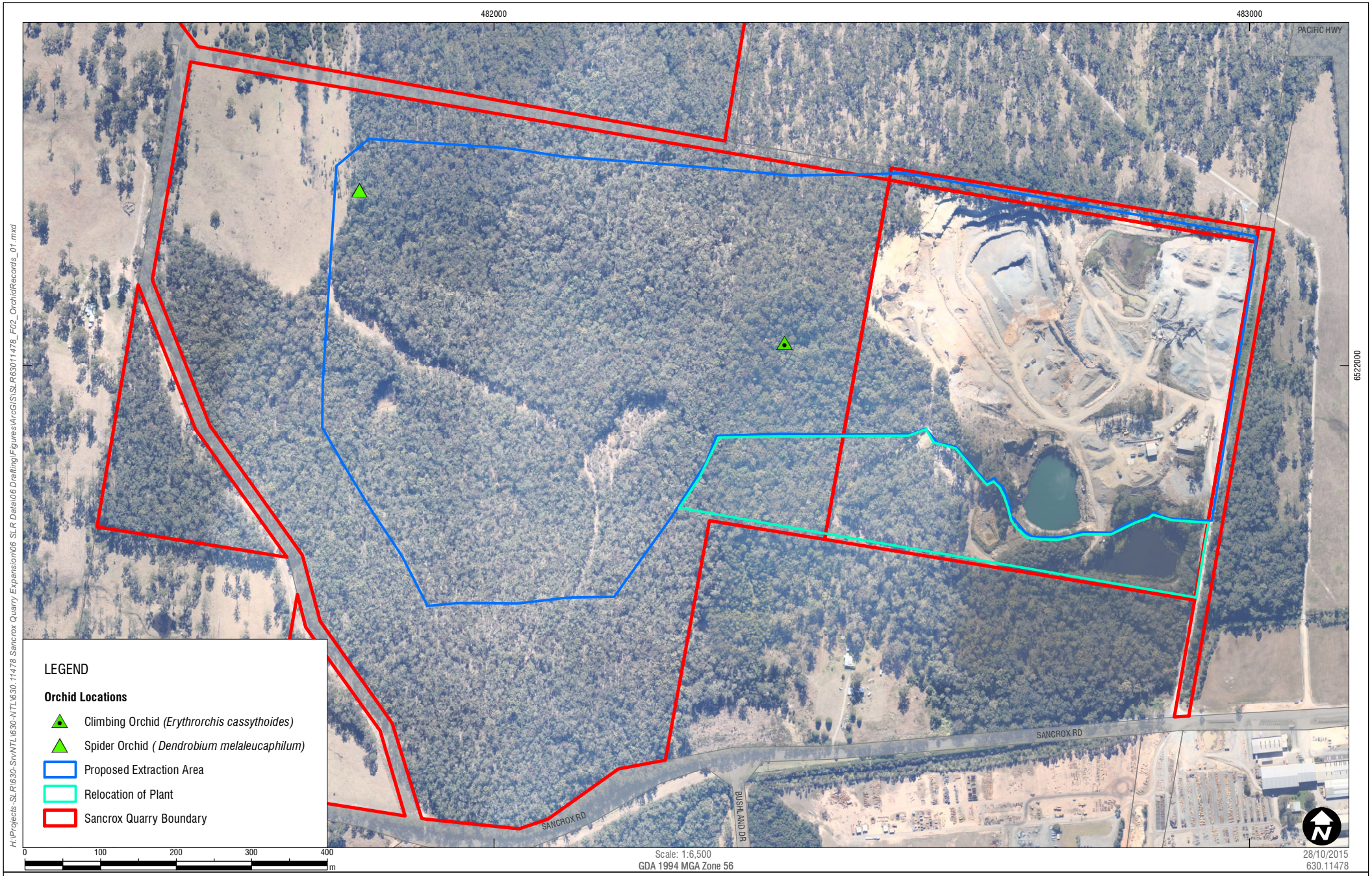
Threatened Orchid Survey
Survey Sites

FIGURE 1



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Threatened Orchid Survey
Orchid Records

FIGURE 2

Threatened Species Database Search Results (BioNet 10 km)

Data from the BioNet Atlas of NSW Wildlife website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ round to 0.1Â°; ^^ rounded to 0.01Â°). Copyright the State of NSW through the Office of Environment and Heritage. Search criteria : Licensed Report of all Valid Records o Threatened (listed on TSC Act 1995) Entities in selected area [North: -31.34 West: 152.71 East: 152.91 South: -31.52] returned a total of 1,705 records of 63 species. Report generated on 29/09/2015 11:56 AM

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records
Animalia	Amphibia	Myobatrachidae	3137	*Crinia tinnula*		Wallum Froglet	V,P		52
Animalia	Amphibia	Myobatrachidae	3075	*^^Mixophyes iteratus*		Giant Barred Frog	E1,P,2	E	1
Animalia	Amphibia	Hylidae	3166	*Litoria aurea*		Green and Golden Bell Frog	E1,P	V	2
Animalia	Amphibia	Hylidae	3169	*Litoria brevipalmata*		Green-thighed Frog	V,P		20
Animalia	Aves	Casuariidae	0001	*Dromaius novaehollandiae*		Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E2,P		1
Animalia	Aves	Anatidae	0216	*Oxyura australis*		Blue-billed Duck	V,P		1
Animalia	Aves	Columbidae	0021	*Ptilinopus regina*		Rose-crowned Fruit-Dove	V,P		1
Animalia	Aves	Ciconiidae	0183	*Ephippiorhynchus asiaticus*		Black-necked Stork	E1,P		45
Animalia	Aves	Ardeidae	0197	*Botaurus poiciloptilus*		Australasian Bittern	E1,P	E	4
Animalia	Aves	Ardeidae	0196	*Ixobrychus flavicollis*		Black Bittern	V,P		1
Animalia	Aves	Accipitridae	0218	*Circus assimilis*		Spotted Harrier	V,P		2
Animalia	Aves	Accipitridae	0225	*Hieraaetus morphnoides*		Little Eagle	V,P		1
Animalia	Aves	Accipitridae	0230	*Lophoictinia isura*		Square-tailed Kite	V,P,3		33
Animalia	Aves	Accipitridae	8739	*Pandion cristatus*		Eastern Osprey	V,P,3		44
Animalia	Aves	Burhinidae	0174	*Burhinus grallarius*		Bush Stone-curlew	E1,P		2
Animalia	Aves	Burhinidae	0175	*Esacus magnirostris*		Beach Stone-curlew	E4A,P		1
Animalia	Aves	Haematopodidae	0131	*Haematopus fuliginosus*		Sooty Oystercatcher	V,P		3
Animalia	Aves	Haematopodidae	0130	*Haematopus longirostris*		Pied Oystercatcher	E1,P		13
Animalia	Aves	Charadriidae	0139	*Charadrius mongolus*		Lesser Sand-plover	V,P	C,J,K	55
Animalia	Aves	Jacanidae	0171	*Irediparra gallinacea*		Comb-crested Jacana	V,P		1
Animalia	Aves	Scolopacidae	0160	*Xenus cinereus*		Terek Sandpiper	V,P	C,J,K	3
Animalia	Aves	Laridae	0117	*Sternula albifrons*		Little Tern	E1,P	C,J,K	12
Animalia	Aves	Cacatuidae	0265	*^^Calyptorhynchus lathami*		Glossy Black-Cockatoo	V,P,2		65
Animalia	Aves	Psittacidae	0260	*Glossopsitta pusilla*		Little Lorikeet	V,P		16
Animalia	Aves	Psittacidae	0309	*Lathamus discolor*		Swift Parrot	E1,P,3	E	4
Animalia	Aves	Strigidae	0246	*Ninox connivens*		Barking Owl	V,P,3		2
Animalia	Aves	Strigidae	0248	*Ninox strenua*		Powerful Owl	V,P,3		12
Animalia	Aves	Tytonidae	0252	*Tyto longimembris*		Eastern Grass Owl	V,P,3		22
Animalia	Aves	Tytonidae	0250	*Tyto novaehollandiae*		Masked Owl	V,P,3		18
Animalia	Aves	Tytonidae	9924	*Tyto tenebricosa*		Sooty Owl	V,P,3		3
Animalia	Aves	Climacteridae	8127	*Climacteris picumnus victoriae*		Brown Treecreeper (eastern subspecies)	V,P		3
Animalia	Aves	Meliphagidae	0603	*Anthochaera phrygia*		Regent Honeyeater	E4A,P	CE	2
Animalia	Aves	Neosittidae	0549	*Daphoenositta chrysoptera*		Varied Sittella	V,P		23
Animalia	Aves	Campephagidae	0428	*Coracina lineata*		Barred Cuckoo-shrike	V,P		1
Animalia	Aves	Petroicidae	0380	*Petroica boodang*		Scarlet Robin	V,P		1
Animalia	Mammalia	Dasyuridae	1008	*Dasyurus maculatus*		Spotted-tailed Quoll	V,P	E	32
Animalia	Mammalia	Dasyuridae	1017	*Phascogale tapoatafa*		Brush-tailed Phascogale	V,P		5
Animalia	Mammalia	Dasyuridae	1045	*Planigale maculata*		Common Planigale	V,P		4
Animalia	Mammalia	Phascolarctidae	1162	*Phascolarctos cinereus*		Koala	V,P	V	805
Animalia	Mammalia	Petauridae	1136	*Petaurus australis*		Yellow-bellied Glider	V,P		9
Animalia	Mammalia	Petauridae	1137	*Petaurus norfolcensis*		Squirrel Glider	V,P		24
Animalia	Mammalia	Potoroidae	1187	*Aepyprymnus rufescens*		Rufous Bettong	V,P		1
Animalia	Mammalia	Pteropodidae	1280	*Pteropus poliocephalus*		Grey-headed Flying-fox	V,P	V	121
Animalia	Mammalia	Pteropodidae	1294	*Syconycteris australis*		Common Blossom-bat	V,P		1
Animalia	Mammalia	Emballonuridae	1321	*Saccolaimus flaviventris*		Yellow-bellied Sheathtail-bat	V,P		2
Animalia	Mammalia	Molossidae	1329	*Mormopterus norfolkensis*		Eastern Freetail-bat	V,P		20
Animalia	Mammalia	Vespertilionidae	1354	*Chalinolobus nigrogriseus*		Hoary Wattled Bat	V,P		1
Animalia	Mammalia	Vespertilionidae	1372	*Falsistrellus tasmaniensis*		Eastern False Pipistrelle	V,P		2
Animalia	Mammalia	Vespertilionidae	1369	*Kerivoula papuensis*		Golden-tipped Bat	V,P		5
Animalia	Mammalia	Vespertilionidae	1346	*Miniopterus australis*		Little Bentwing-bat	V,P		68

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records
Animalia	Mammalia	Vespertilionidae	1834	*Miniopterus schreibersii oceanensis*		Eastern Bentwing-bat	V,P		28
Animalia	Mammalia	Vespertilionidae	1357	*Myotis macropus*		Southern Myotis	V,P		18
Animalia	Mammalia	Vespertilionidae	1361	*Scoteanax rueppellii*		Greater Broad-nosed Bat	V,P		18
Animalia	Mammalia	Vespertilionidae	1025	*Vespadelus troughtoni*		Eastern Cave Bat	V,P		10
Animalia	Mammalia	Muridae	1466	*Pseudomys gracilicaudatus*		Eastern Chestnut Mouse	V,P		14
Animalia	Mammalia	Dugongidae	1558	*Dugong dugon*		Dugong	E1,P		2
Plantae	Flora	Apocynaceae	1226	*Cynanchum elegans*		White-flowered Wax Plant	E1,P	E	1
Plantae	Flora	Casuarinaceae	8980	*Allocasuarina defungens*		Dwarf Heath Casuarina	E1,P	E	9
Plantae	Flora	Juncaginaceae	3363	*Maundia triglochinoides*			V,P		3
Plantae	Flora	Myrtaceae	4134	*Eucalyptus nicholii*		Narrow-leaved Black Peppermint	V,P	V	3
Plantae	Flora	Myrtaceae	6809	*Melaleuca biconvexa*		Biconvex Paperbark	V,P	V	27
Plantae	Flora	Orchidaceae	6630	*^^Dendrobium melaleucaphilum*		Spider orchid	E1,P,2		1
Plantae	Flora	Orchidaceae	4480	*^^Phaius australis*		Southern Swamp Orchid	E1,P,2	E	1

APPENDIX K

EPBC Act PMST Search Results

Australian Government
Department of the Environment and Energy

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.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

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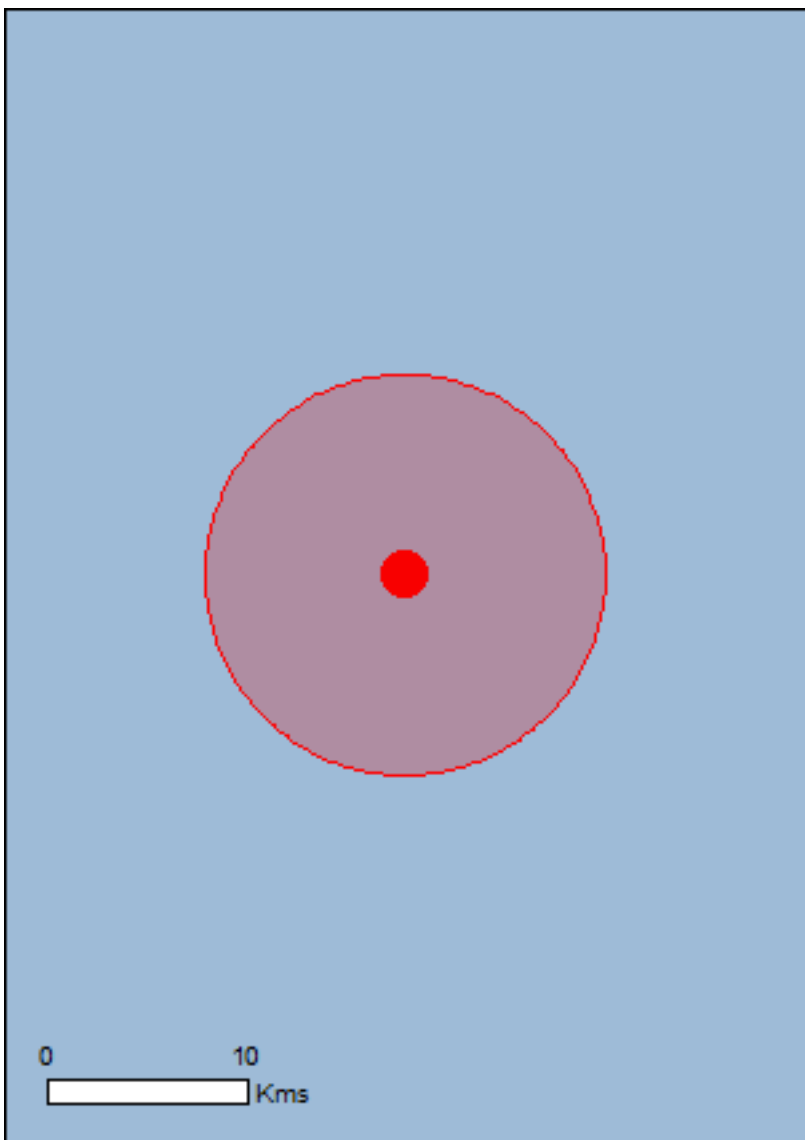

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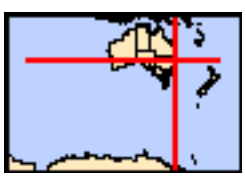

Summary

Matters of National Environmental 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:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	62
Listed Migratory Species:	56

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 environment anywhere.

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 Land:	5
Commonwealth Heritage Places:	None
Listed Marine Species:	61
Whales and Other Cetaceans:	1
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	8
Regional Forest Agreements:	1
Invasive Species:	36
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

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.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	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]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
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 known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	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 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

Name	Status	Type of Presence
		to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	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
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may 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	Species or species habitat may 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 known to occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	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 cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to 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	Species or species habitat may occur within area

Name	Status	Type of Presence
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
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 likely to occur within area
Mixophyes iteratus Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat likely to occur within area
Insects		
Argynnis hyperbius inconstans Australian Fritillary [88056]	Critically Endangered	Species or species habitat likely to occur within area
Mammals		
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
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known 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]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
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	Roosting known to occur within area
Plants		
Acronychia littoralis Scented Acronychia [8582]	Endangered	Species or species habitat likely 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 known to occur within area

Name	Status	Type of Presence
Arthraxon hispidus Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area
Asperula asthenes Trailing Woodruff [14004]	Vulnerable	Species or species habitat known to 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
Hakea archaeoides [66702]	Vulnerable	Species or species habitat likely to 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
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat known to occur within area
Parsonsia dorrigoensis Milky Silkpod [64684]	Endangered	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may 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 likely to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour 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	Foraging, feeding or related behaviour likely to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence

Name	Threatened	Type of Presence
Migratory Marine Birds		
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
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
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	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
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	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 cauta Tasmanian Shy Albatross [89224]	Vulnerable*	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	Species or species habitat may 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*	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Migratory Marine Species		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		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
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur

Name	Threatened	Type of Presence 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 known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting may occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely 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
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [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.

Name
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Postal Corporation
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Service Homes Corporation
Commonwealth Land - Telstra Corporation Limited

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
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
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting 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 known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur

Name	Threatened	Type of Presence
		within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to 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
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	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
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting may occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		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 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	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		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
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	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 cauta Tasmanian Shy Albatross [89224]	Vulnerable*	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	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour likely to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Xenus cinereus		
Terek Sandpiper [59300]		Roosting known to occur within area
Mammals		
Dugong dugon		
Dugong [28]		Species or species habitat may occur within area
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour 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	Foraging, feeding or related behaviour likely to occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Sousa chinensis		
Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Forestry Management Areas in Wauchope	NSW
LNE Special Management Zone No1	NSW
Lake Innes	NSW
Lake Innes	NSW
Limeburners Creek	NSW
Queens Lake	NSW
Rawdon Creek	NSW
Woregore	NSW

Regional Forest Agreements	[Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		

Name	Status	Type of Presence
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur

Name	Status	Type of Presence within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar		Species or species

Name	Status	Type of Presence
Groundsel [2624]		habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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.

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

Where very little information is available for 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 reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

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

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

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

Coordinates

-31.43601 152.81544

Acknowledgements

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-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
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-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
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-Other groups and individuals

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Please feel free to provide feedback via the Contact Us page.

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