APPENDIX 7. BIODIVERSITY OFFSET STRATEGY

Preliminary Documentation

Cabbage Tree Road Sand Quarry - (EPBC 2016-7852)

APPENDIX 5. BIODIVERSITY OFFSET STRATEGY

RESPONSE TO SUBMISSIONS
CABBAGE TREE ROAD SAND QUARRY (SSD 13_6125)

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Biodiversity Offset Strategy

Williamtown Sand Syndicate

Proposed Sand Quarry

Cabbage Tree Road, Williamtown NSW

13 October 2016

Biodiversity Offset Strategy

Proposed Sand Quarry

Cabbage Tree Road, Williamtown NSW

Kleinfelder Document Number: NCA16R42798
Project Number: 20170448

Prepared for:

WILLIAMTOWN SAND SYNDICATE

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Document Control:

Version	Description	Date	Author(s)	Reviewer(s)
1.0	Final	13 October 2016	S. Schulz	A. Blundell

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EXECUTIVE SUMMARY

Kleinfelder were commissioned by Williamtown Sand Syndicate Pty Ltd (WSS) to prepare a Biodiversity Offset Strategy for a proposed sand quarry located at Lot 1 DP 224587, Lot 121 DP 556403, Lot 11 DP 629503 and Lot 1012 DP 814078, Cabbage Tree Road, Williamtown NSW (Subject Land). This Biodiversity Offset Strategy has been prepared to address the Director General's Requirements (DGRs) (SDD 6125, 14 October 2013), specifically the requirement to prepare 'a comprehensive offset strategy to ensure the development maintains or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term'. This report provides an assessment of proposed offset measures for the development, including their suitability to compensate for loss of biodiversity values on the proposed development site through application and consideration of the Biobanking Assessment Methodology (BBAM) 2014. Additionally, the following policies will be utilised; NSW OEH Interim Policy on assessing and offsetting biodiversity impacts of Part 3A, State Significant Development (SDD) and State Significant Infrastructure (SII) Projects (OEH 2011), and NSW Biodiversity Offsets Policy for Major Projects (OEH 2014).

The total area of the Subject Land is 176.12 ha. The development site (42.25 ha) is located in the western and central parts of the Subject Land, within the areas of higher elevation. This impact area is inclusive of all extraction and operational areas that would be impacted by the proposal. The majority of the development site is within Lot 1 in DP224587, with a small area extending through the central portions of Lot 121 in DP 556403 and Lot 11 in DP 629503. In response to submissions from authorities and the community, regarding the original proposal, WSS has redesigned the development footprint to avoid important ecological features. The impact area has been reduced by approximately 22.5%.

It is proposed that the majority of the land not subject to development be secured as a biobank site. The proposed biobank is 131.12 ha and occupies the majority of the remaining areas of the Subject Land (130.14 ha of native vegetation and 0.99 ha cleared tracks). There is a small area of exotic vegetation (1.26 ha) in the south east corner of the Subject Land and a small strip of land along the south-western boundary (1.46 ha), both of which have been excluded from the proposed biobank.

An assessment of the development site and biobank site was undertaken in accordance with the BBAM 2014. The assessment determined that the impact at the development site requires a total of 2,207 ecosystems credits for impact on HU860 and 17,479 Eucalyptus camfieldii, *3,220* Eucalyptus parramattensis *subsp.* decadens, *525 Eastern Osprey, 1,050 Koala and 9 Wallum Froglet species credits. The assessment determined that the biobank site would generate a total of 1,189 ecosystem credits comprised of HU860, HU851, HU917, HU865, HU938, and HU948, and 11,651* Eucalyptus camfieldii, *4,501* Eucalyptus parramattensis

subsp. decadens*, 724* Grevillea parviflora *subsp.* parviflora, *717 Eastern Osprey, 744 Koala and 606 Wallum Froglet species credits*.

The following table summarises the credits generated at the impact site and the credits that will be retired at the biobank to fulfil, or partially fulfil these credit requirements.

Credit Type	***Credits Requirements (Impact Site)***	***Credits at the Biobank: To be Retired (% of credit requirement meet)***	
HU860 Ecosystem Credits	*2,207*	*HU860*	*273*
		HU851	*311*
		HU917	*80*
		HU965	*22*
		HU938	*388*
		HU948	*115*
		Total	***1,189 (54% of credits required)***
Eucalyptus camfieldii	*17,479*	Eucalyptus camfieldii	*11,651*
		Eucalyptus parramattensis *subsp.* decadens	*1,281*
		Grevillea parviflora *subsp.* parviflora	*724*
		Total	***13,656 (78% of credits required)***
Eucalyptus parramattensis *subsp.* decadens	*3,220*	*3,220 (100% of credits required)*	
Eastern Osprey	*525*	*717 (137% of credits required)*	
Koala	*1,050*	*744 (71% of credits required)*	
Wallum Froglet	*9*	*606 (6,733% of credits required))*	

It is proposed to retire all ecosystem credits created at the biobank site (total 1,189 ecosystem credits), as per variation criterion (f) for mitigated net loss (tier 3) under the Interim Policy, to partially fulfil the ecosystem credit requirements at the development site, this would fulfil 54% of the ecosystem credit requirements. This variation criterion allows for conversion of ecosystem credits to a regional conservation priority as identified in a regional conservation plan or similar. The proposed biobank is of high conservation value due to its location, as it occurs adjacent to Tilligerry SCA, proposed Hunter Water biobank sites and mapped fauna habitat and corridors; quality of vegetation, as it supports moderate to good vegetation that is predominantly old-growth; and the presence of threatened species and ecological communities within the site.

Willimatown Sand Syndicate are committed to retiring between 80% - 85% of the required ecosystem credits for the development, utilising the ecosystem credits generated at the on-site biobank and additional credits available at a potential off-site biobank located to the east of Williamtown Airport. The retirement of this proportion of ecosystem credits is considered adequate for the proposed development, given that the impact area predominantly contains rehabilitated or regenerating vegetation (54% of the impact area), and the majority of the vegetation within the on-site and potential off-site biobank sites is old-growth forest. Additionally, both the on-site and potential offsite biobanks contain a threatened ecological community (Swamp Sclerophyll Forest) and multiple threatened species (based on historical records).

The biobank site fulfils the species credit requirements for impacts on Eucalyptus parramattensis *subsp.* decadens*, Eastern Osprey and Wallum Froglet. The biobank site does not generate enough species credits for* Eucalyptus camfieldii*, with a shortfall of 5,828 species credits, and the Koala, with a shortfall of 306 species credits.*

The biobank fulfils 67% of the species credits required for Eucalyptus camfieldii at the development site. As such it is proposed to apply Variation Criteria (B) – Convert one type of species credit to another type of species credit with the same or more endangered conservation status, under Tier 3: Negotiation a "Mitigated Net Loss Outcome" of the OEH Interim Policy (OEH 2011). There are residual species credits generated at the Biobank site for E. parramattensis *subsp.* decadens *(1,281) and* G. parviflora *subsp.* parviflora *(724). As such the total number of species credits available at the biobank to offset impacts on* E. camfieldii *at the development site is 13,656 (78% of the required 17,479 credits). The fulfilment of 78% of the required* E. camfieldii *species credits is considered adequate. As the majority of the* E. camfieldii *within the development site is part of a planted (rehabilitated) population, it is highly unlikely that the species would have been present in this area prior to rehabilitation. Additionally, the species will be replanted within the rehabilitation area, as it will represent potential habitat for the species due to the lower elevation of the final landform. Furthermore, there are additional species credits generated at the biobank for both the Eastern Osprey and Wallum Froglet. While these fauna species credits may not directly transfer to offset impacts against E. camfieldii, WSS propose to retire these credits as part of the offset package for the development.*

Williamtown Sand Syndicate are committed to retiring the remaining 306 Koala species credits at an off-site offset within the Tomago Sandbeds KMU. Williamtown Sand Syndicate are currently investigating potential freehold land to the east of Williamtown Airport to establish a biobank. Based on a desktop assessment, the land contains preferred and supplementary Koala habitat and could potential fulfil the remaining Koala credit requirements, within the Tomago Sandbeds KMU.

Specific management actions proposed for the biobank site to address each of the standard and relevant additional management actions listed under BBAM 2014 have also been outlined in this report to enable retirement of ecosystem and species credits. Key management actions include weed control, vertebrate pest control, installation and maintenance of fencing and signage, preparation and implementation of a fire management plan, and erosion and sediment control.

Contents

Tables

Figures

Appendices

ABBREVIATIONS

BBAM	BioBanking Assessment Methodology (2014)
Biobank site	The area located within the Subject Land, but excludes the development site and any other land within the Subject Land that is not incorporated into the offset strategy.
Calculator	BBAM Credit Calculator
Development site	Covers the development footprint only and is located within the Subject Land, comprising the resource area and the road connecting the north and south resource deposits.
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
GIS	Geographic Information System
ha	hectares
IBRA	Interim Biogeographic Regionalisation of Australia
OEH	Office of Environment and Heritage (NSW)
RDP	Rapid Point Data
SCs	Species Credits
Subject Land	The four contiguous properties including both the development site and the biobank site.
EEC	Endangered Ecological Community (as defined under NSW Legislation)
TSC Act	*Threatened Species Conservation Act* 1995 (NSW)

STAGE 1: BIODIVERSITY ASSESSMENT

1.1 INTRODUCTION

Kleinfelder were commissioned by Williamtown Sand Syndicate Pty Ltd (WSS) to prepare a Biodiversity Offset Strategy for a proposed sand quarry located at Lot 1 DP 224587, Lot 121 DP 556403, Lot 11 DP 629503 and Lot 1012 DP 814078, Cabbage Tree Road, Williamtown NSW (Subject Land). This Biodiversity Offset Strategy has been prepared to address the Director General's Requirements (DGRs) (SDD 6125, 14 October 2013), specifically the requirement to prepare:

- *A comprehensive offset strategy to ensure the development maintains or improves the terrestrial and aquatic biodiversity values of the region in the medium to long term.*

Additionally, this strategy addresses issues pertaining to the 'Provision of Biodiversity Offsets/Compensatory Habitat Package' raised by the Office of Environment and Heritage (OEH), detailed in a Review of Cabbage Tree Road Sand Quarry Environmental Impact Statement (SDD 6125) – Williamtown letter (DOC15/491264-2).

The application for this State Significant Development (SSD) was submitted in the interim period between the repeal of Part 3A and release of the Framework for Biodiversity Assessment (FBA), as such OEH have requested the use of the Biobanking Assessment Methodology (BBAM) 2014 to determine offsetting requirements. Additionally, the following policy can be applied in the determination of offset requirements for the development; *NSW OEH Interim Policy on assessing and offsetting biodiversity impacts of Part 3A, State Significant Development (SDD) and State Significant Infrastructure (SII) Projects* (OEH 2011).

This report provides an assessment of proposed offset measures for the development, including their suitability to compensate for loss of biodiversity values on the proposed development site. This report has been structure to comply with the reporting requirements biobanking applications, as detailed in Appendix 9 of the BBAM 2014.

1.1.1 Subject Land

The Subject Land is approximately 176.12 ha and consists of Lot 1 DP 224587, Lot 121 DP 556403, Lot 11 DP 629503 and Lot 1012 DP 814078. The Subject Land is owned by Port Stephens Council (PSC) whom have entered into a lease agreement with WSS to develop and operate the proposed sand quarry. As the landowner, PSC, have granted consent for the land

outside the impact area to be used as may be proposed within an approved biodiversity offset strategy (**Appendix 1**).

The quarry would involve the extraction of up to 530,000 tonnes per year of sand and therefore meets the criteria listed in Schedule 1 clause 7(1)(a) of *State Environmental Planning Policy - State and Regional Development 2011* for assessment as 'State significant development' under Section 89C of the *Environmental Planning and Assessment* (EP&A) *Act 1979*.

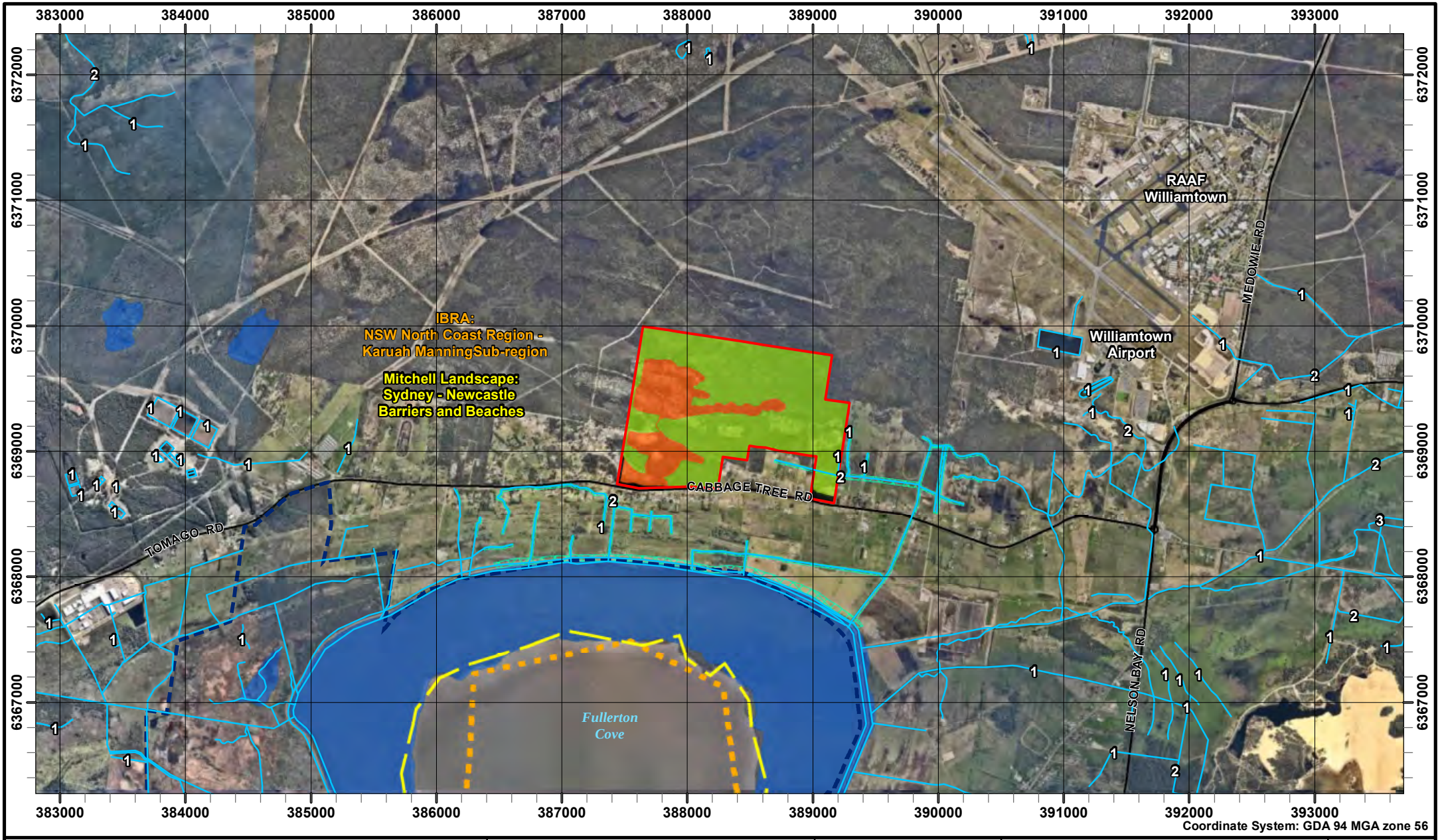
The Subject Land is zoned RU2 Rural Landscape under Port Stephens Council Local Environmental Plan (LEP) 2013 which permits development for extractive industries. The Subject Land is located in the south-east Tomago Sandbeds approximately 2 km west of Newcastle Airport. The Hunter Estuary (Fullerton Cove) is located approximately 600 m to the south. The Subject Land has high connectivity with Tilligerry State Conservation Area (SCA) adjoining north-west of the site. The western boundary and the north-eastern boundaries of the site adjoin vegetated land owned by Hunter Water, which are currently being investigated as potential biobanking sites.

The majority of the Subject Land contains remnant native vegetated. Previous sand extraction and associated disturbances have occurred within the Subject Land, as a result there are areas of naturally regenerating native vegetation and native rehabilitation. Previous disturbances include; heavy mineral sand mining, silica extraction, settling ponds, sand tailings areas, potential monazite trenches, Ilmenite stockpile, scarp yard, infrastructure areas and illegal dumping. More recently, a bushfire occurred across the site in November 2013.

A Location Map is provided in **Figure 1**.

1.1.1.1 Development site

The development site (42.25 ha) is located in the western and central parts of the Subject Land, within the areas of higher elevation. This impact area is inclusive of all extraction and operational areas that will be impacted due to the proposal. The majority of the development site is within Lot 1 in DP224587, with a small area extending through the central portions of Lot 121 in DP 556403 and Lot 11 in DP 629503. The development site is predominately vegetated with dry sclerophyll forest (40.38 ha), approximately half of which is either rehabilitation or regenerating forest (21.85 ha). A small portion of the development site consists of un-vegetated previous extraction areas and access tracks (1.88 ha). The northern section of the impact area was previously subject to heavy mineral sand mining. A Site Map is provided in **Figure 2**.



Legend

- Subject Land (176.1 ha)
- Biobank Site (131.1 ha)
- Development Site (42.3 ha)
- Excluded Area (2.7 ha)
- Mapped Rivers & Streams (labelled with stream order)
- Riparian Buffers
- Mitchell Landscapes Boundary (V3)
- IBRA Subregion Boundary (V7)
- SEPP14 Coastal Wetlands
- Ramsar Wetland Boundary
- Arterial Road

km
0 0.25 0.5 1 1.5 2
N

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DATE DRAWN: 13/10/2016 17:22 Version 1
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DATA SOURCE:
NSW Land and Property Information - 2011
NSW Department of Planning & Environment - 2015
Hunter Central Rivers CMA - 2012
NearMap - 2016

Location Map - Development Site & Biobank Site

Williamtown Sand Syndicate
Offset Strategy
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE: 1

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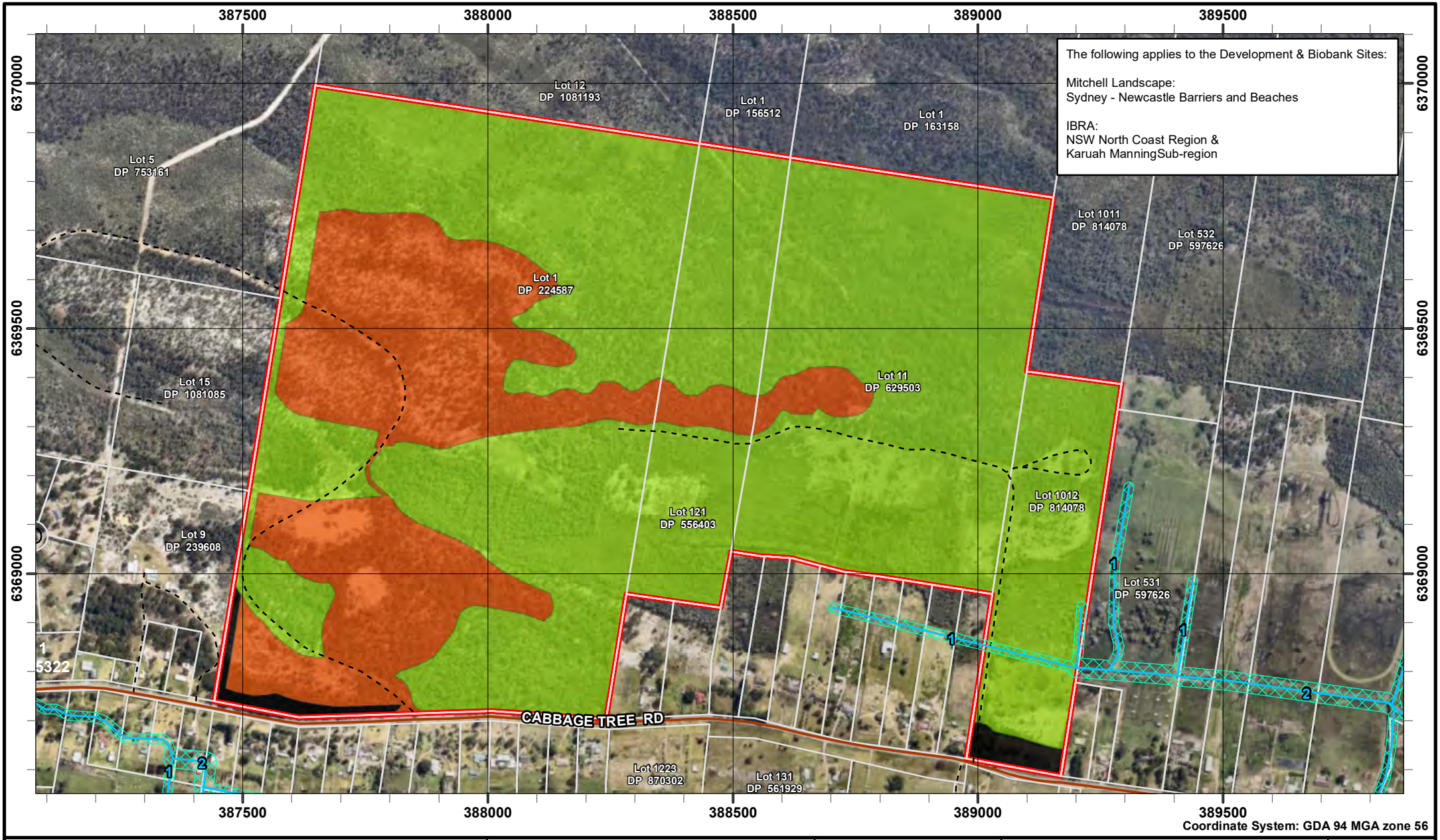

Legend

- Subject Land (176.1 ha)
- Development Site (42.3 ha)
- Biobank Site (131.1 ha)
- Excluded Area (2.7)
- Riparian Buffers
- Mapped Rivers & Streams (labelled with stream order)
- Lot Boundaries
- Arterial Road
- Local Road
- Track

Metres
0 50 100 200 300 400 500
N

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Site Map - Development Site & Biobank Site

Williamtown Sand Syndicate
Offset Strategy
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE: 2

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1.1.1.2 Biobank Site

It is proposed that the land not subject to development be secured as a biobank site. The proposed biobank is 131.14 ha and occupies the majority of the remaining areas of the Subject Land. There is a small area of exotic vegetation (1.26 ha) in the south east corner of the Subject Land and a small strip of land along the south-western boundary (1.46 ha), both of which have been excluded from the proposed biobank. The vegetation within the biobank site consists of dry sclerophyll forests, forested wetlands and freshwater wetlands. A Site Map of the biobank is provided in **Figure 2**.

1.2 LANDSCAPE FEATURES

1.2.1 Identification of Landscape Features

The landscape features detailed in Section 4.1 of the BBAM 2014 including IBRA bioregion, IBRA subregion, Mitchell landscape, rivers and streams, wetlands, and the extent of native vegetation in the outer assessment circle for both the development site and biobank site are described in **Table 1**. These landscape features are also shown in **Figure 1**.

Table 1: Landscape features of the development site and biobank site

Landscape Feature	Development Site	Biobank Site
IBRA bioregion	North Coast	North Coast
IBRA subregion	Karuah - Manning	Karuah - Manning
Mitchell landscape	Sydney – Newcastle Barriers and Beaches	Sydney – Newcastle Barriers and Beaches
River, streams and estuaries	No rivers, streams or estuaries (or associated riparian buffers) occur within the development site	The biobank site contains one 1st order stream and associated riparian buffers.
Wetlands	No wetlands occur within the development site. A SEPP 14 wetland occurs approximately 700 m to the south of the development site.	No important wetlands within the biobank. A SEPP 14 wetland occurs approximately 700 m to the south of the biobank site.
Native vegetation extent	See Section 1.3	See Section 1.3
State or regionally significant biodiversity links	None identified	None identified

1.2.2 Determining Landscape Values

1.2.2.1 Development Site

The landscape assessment for the development site was undertaken in accordance with Section 4.2 and Appendix 4 (i.e. site-based development) of the BBAM 2014 through a combination of GIS analysis and ground-truthing.

The current and future linkage width classes for the site were determined to be > 500 m through aerial photo analysis, and the current and future linkage condition classes for overstorey and midstorey/ground cover of all sites were determined to be within benchmark through a combination of aerial photo analysis and ground-truthing. The patch size was determined to be >1,000 ha through aerial photo analysis. Details of the landscape assessment are provided in **Table 2** and **Figure 3**.

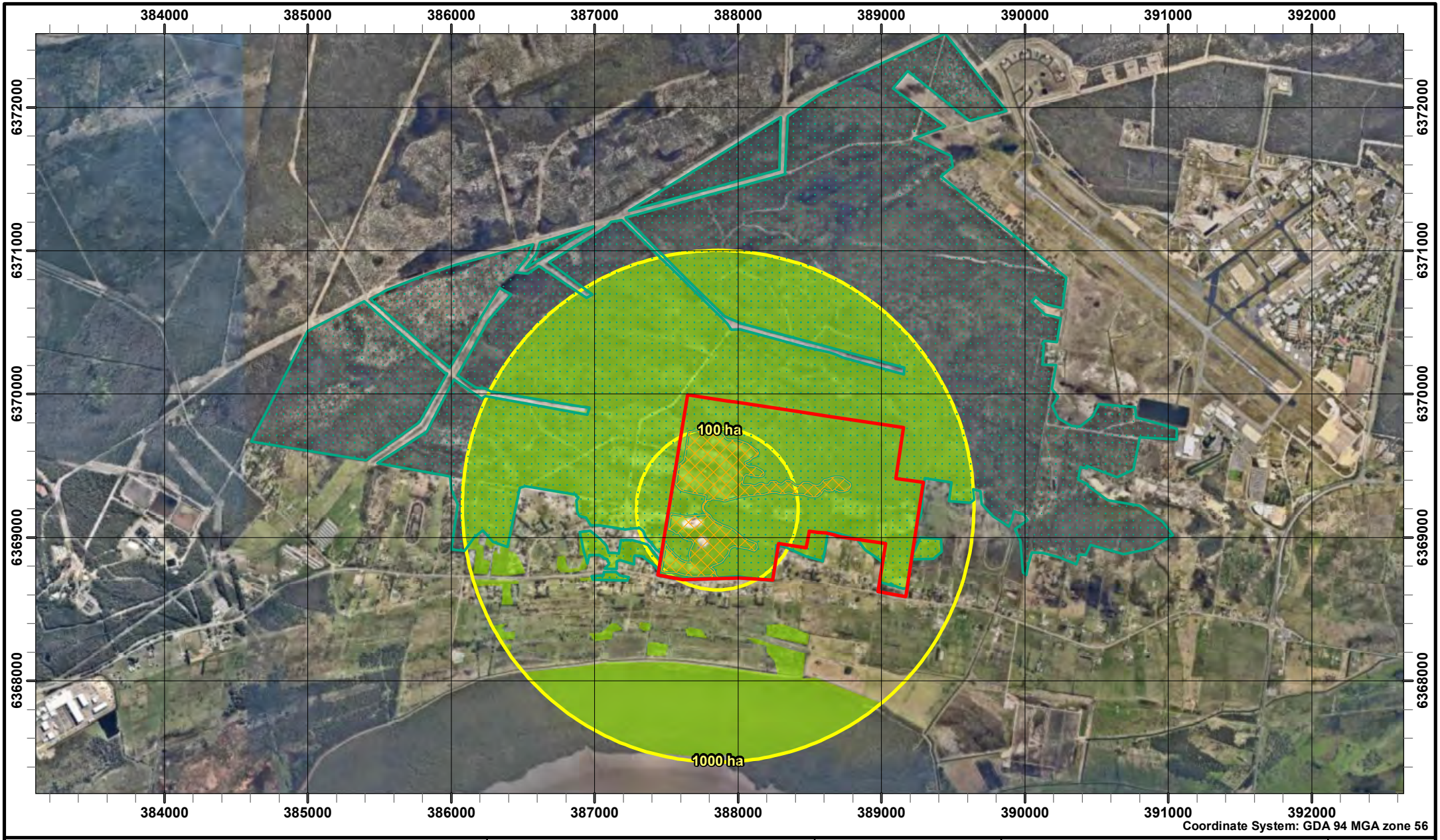
Table 2: Development site landscape assessment

Assessment Circle	Vegetation cover before development	Vegetation cover after development
100 ha circle	94%	56%
1,000 ha circle	72%	68%
Connectivity Assessment	**Before development**	**After development**
Linkage width	>500 m	>500 m
Linkage condition class	3	3
Patch Size	**Landscape Value Score**	
>1,000 ha	14.4	

1.2.2.2 Biobank Site

The landscape assessment for the biobank site was undertaken in accordance with Section 4.2 and Appendix 6 (i.e. biobanks sites) of the BBAM 2014 through a combination of GIS analysis and ground-truthing.

The current and future linkage width classes for the site were determined to be > 500 m through aerial photo analysis, and the current and future linkage condition classes for overstorey and midstorey/ground cover of all sites were determined to be within benchmark through a combination of aerial photo analysis and ground-truthing. The patch size was determined to be >1,000 ha through aerial photo analysis. Details of the landscape assessment are provided in **Table 3** and **Figure 4.**



Coordinate System: GDA 94 MGA zone 56

Legend

- Subject Land (176.1 ha)
- Development Site (42.3 ha)
- Native Vegetation Extent (within assessment circles)
- Patch Extent (>1,000 ha)
- Assessment Circles

km
0 0.25 0.5 1 1.5 2
N

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DATE DRAWN: 13/10/2016 17:24 Version 1
DRAWN BY: gjoyce
DATA SOURCE:
NSW Land and Property Information - 2011
nearmap - 2016

Landscape Assessment - Development Site

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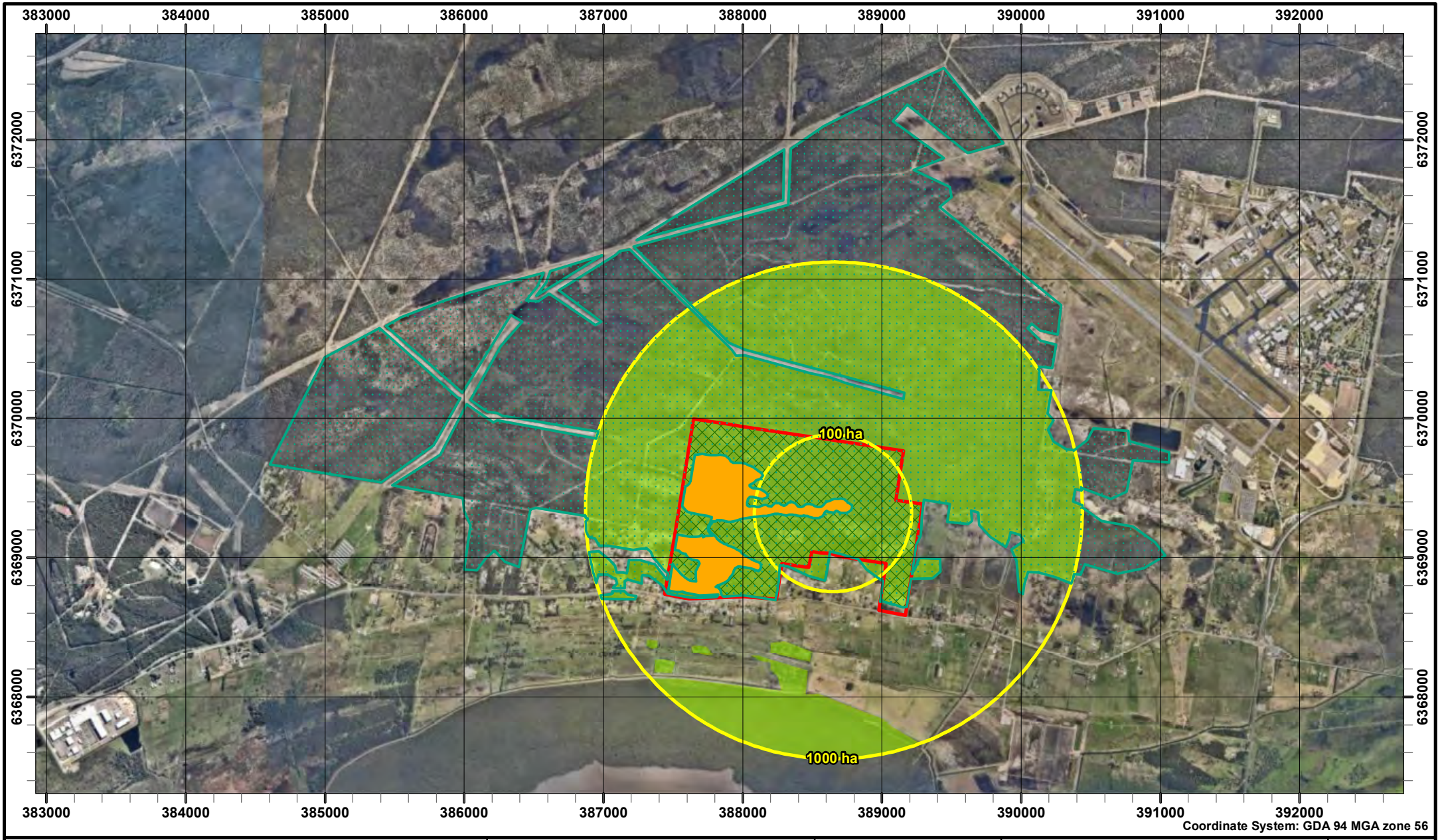
Cabbage Tree Road, Williamtown

FIGURE:
3

L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_OS_Fig03_DevelopmentSite_LandscapeAssessment.mxd



Coordinate System: GDA 94 MGA zone 56

Legend

- Subject Land (176.1 ha)
- BiobankSite (133.1 ha)
- Development Site (42.3 ha)
- Native Vegetation
- Assessment Circles
- Patch Extent (>1,000 ha)

km
0 0.25 0.5 1 1.5 2
N

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DATE DRAWN: 13/10/2016 17:26 Version 1
DRAWN BY: gjoyce

DATA SOURCE:
NSW Land and Property Information - 2011
nearmap - 2016

Landscape Assessment - Biobank Site

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Cabbage Tree Road, Williamtown

FIGURE: 4

L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_OS_Fig04_BiobankSite_LandscapeAssessment.mxd

Table 3: Biobank site landscape assessment

Assessment Circle	Vegetation cover before biobank	Vegetation cover after biobank
100 ha circle	84%	84%
1,000 ha circle	67%	67%
Connectivity Assessment	**Before biobank**	**After biobank**
Linkage width	>500 m	>500 m
Linkage condition class	3	3
Patch Size	**Landscape Value Score**	
>1,000 ha	12.00	

1.3 NATIVE VEGETATION

1.3.1 Methodology

Native vegetation was assessed in accordance with Section 5 of the BBAM 2014. Further detail on the specific methods used to undertake the assessment of the native vegetation is provided in the following subsections.

1.3.1.1 Review of Previous Studies

Two previous assessments conducted across the Subject Land and several regional vegetation studies were reviewed prior to conducting the vegetation assessment within the Subject Land. These studies were used to assist with the stratification of the site into vegetation zones, selection of plot/transect locations and determination of plant community types (PCTs), as per the BBAM 2014, these included:

- *Ecological Constraints and Opportunities Assessment* (RPS 2011)
- *Ecological Assessment* (Umwelt 2015a) - Appendix 8 of the Environmental Impact Statement (Umwelt 2015b) prepared for the proposed sand quarry;
- *Vegetation of the Tomago and Tomaree Sandbeds*, Port Stephens NSW (Bell and Driscoll, 2006);
- *Vegetation Survey Classification and Mapping Lower Hunter and Central Coast Region* (LHCCREMS; NPWS 2000); and
- *Hunter, Central and Lower North Coast Vegetation Classification and Mapping Project* (Somerville, 2009).

1.3.1.2 Vegetation Survey and Mapping

Vegetation surveys and mapping was conducted by Kleinfelder in 2016. The field surveys were conducted in accordance with the BBAM 2014, the methodology used is outlined in the following sections.

Aerial Photo Interpretation

Prior to field surveys, the spatial distribution of the vegetation and key features across the development and biobank sites were mapped remotely from aerial photography and satellite imagery through systematic visual inspection by an experienced botanist. This process involved digitising polygons around vegetation patches with homogenous combinations of the following parameters: dominant species, ground cover, woody cover, and growth stage at a scale of approximately 1:500 using a Geographic Information System (GIS) (ArcGIS). The latest Nearmap © imagery available for the site from October 2015 was used as the primary basis for all linework and attribution.

Field Surveys

Vegetation surveys were conducted across the development and biobank sites on 6 and 9 - 13 May, 16 June, 1 July, 9 and 11 August 2016. The boundaries of each of the identified vegetation communities within the biobank site were mapped using a combination of rapid data points (RDP) and walking transects, using the polygons produced through aerial photo interpretation (API) to assist in targeting survey effort. RDPs involved collecting waypoints over the study area using a hand held Trimble™ GPS unit and recording dominant species, structure and condition. Walking transects involved verifying polygons were homogenous in floristic composition and condition, as well as walking vegetation ecotones and using the recorded tracks to define vegetation community boundaries. The RDPs and survey tracks were then overlaid on an aerial photograph and used to delineate and/or clarify vegetation boundaries.

Plot-based full floristic surveys, using 20 m x 20 m quadrats, were conducted across the development and biobank sites. A total of 11 floristic quadrats were sampled within the development site and a total of 34 were conducted within the biobank site. Within each quadrat the information detailed in Table 1, Section 5.2.1.7 of the BBAM 2014 was collected, including stratum, growth form, species name, cover and abundance rating for each species (this data has been provided **Appendix 2**).

Linework and Attribution

RDPs and plots were classified and tagged with a PCT by field surveyors. Polygons produced from the API work adopted the PCT of the sample point that they intersected. Field surveyors undertook a desktop inspection of linework, orthophotos and other GIS data (including 2 m

contours, watercourses, and soil landscapes spatial datasets) to attribute any remaining polygons.

Plant Community Type Determination

Each vegetation community identified on the development and biobank sites were assigned to the closest equivalent PCT from those listed in the Vegetation Information System (VIS) Classification Database. The closest equivalent PCT for each vegetation community was determined through a comparison of the floristic descriptions of PCTs in the database with the floristic quadrat data collected from the site. In addition to floristic and structural similarity, the landscape position, soil type and other diagnostic features of the vegetation communities on the sites were also compared to the descriptions in the database in order to determine the most suitable PCT. Threatened ecological communities (TECs) as defined in NSW and Commonwealth legislation were also identified.

Vegetation Zones

Vegetation zones were identified and delineated across the development and biobank sites in accordance with Section 5.2.2 of the BBAM 2014. A vegetation zone is defined in the BBAM 2014 as a relatively homogenous area that is the same vegetation type and broad condition.

Assessing Site Value

Following stratification of the sites into vegetation zones, plots/transects were undertaken to collect site condition value data for each of the 10 attributes listed in Table 2, Section 5.3 of the BBAM 2014. The location of the plots/transects were selected through stratified random sampling to provide a representative sample of the variation in vegetation composition and condition within each vegetation zone.

The number of plots/transects either meets or exceeds the minimum number required for each vegetation zone area as detailed in Table 3, Section 5.3.2 of the BBAM 2014. A total of 11 plots/transects were undertaken across the development site and 34 plots/transects were undertaken across the biobank site. The locations of the plots/transects undertaken on development site and biobank site are shown in **Figure 5** and **Figure 6**, respectively.

1.3.2 Assessment Results

1.3.2.1 Development Site

One plant community types (PCTs) was identified within the development site; HU860: Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast. The vegetation class, area within the development site, species used

for identification, justification for the PCT selection, EEC status and percent cleared of the PCT is outlined in **Table 4**.

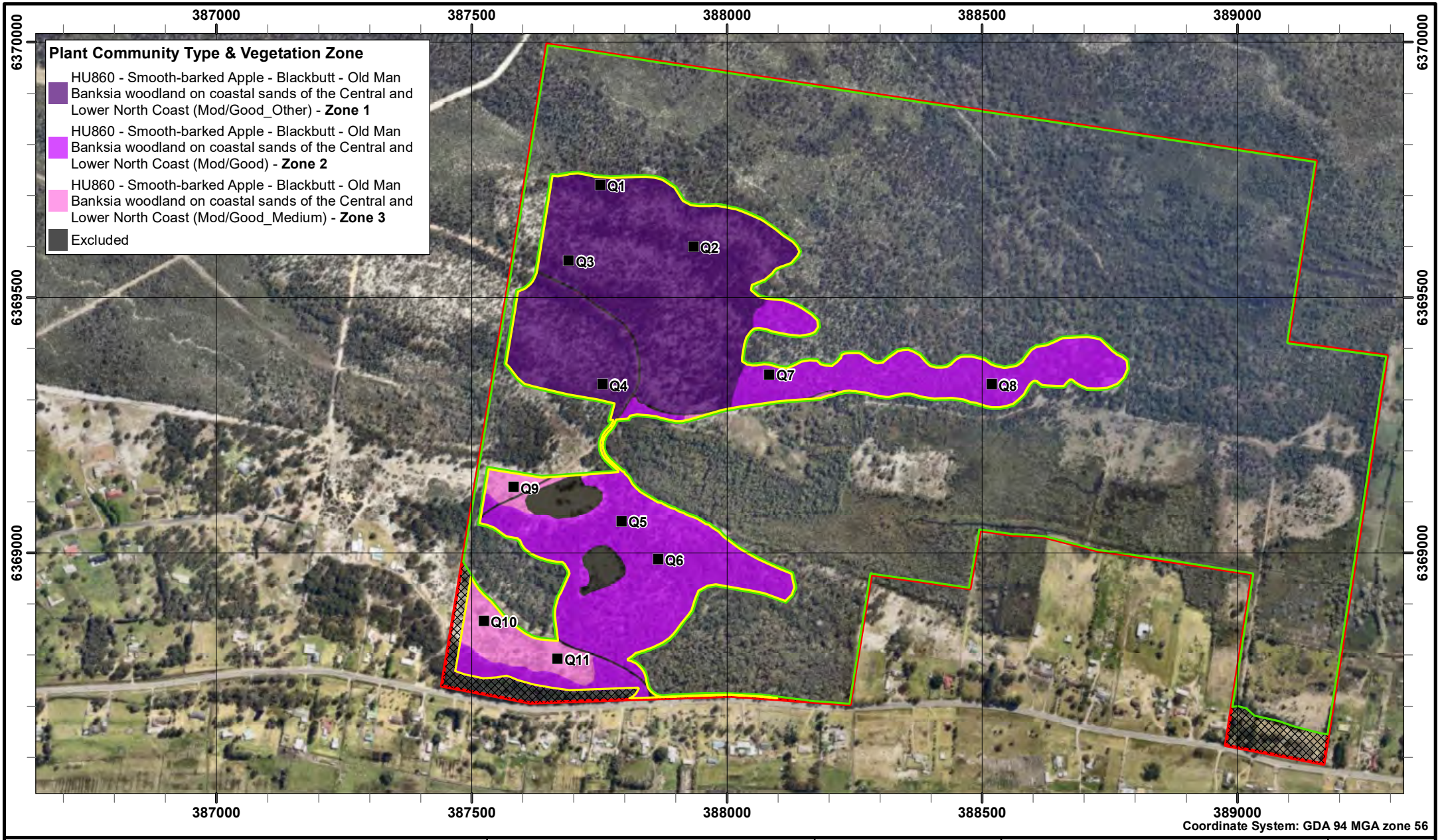
Two small areas of cleared land (previous sand extraction areas) and cleared tracks occur within the development site, total area of 1.88 ha. These areas of cleared land do not constitute a PCT and were not assessed, as per Table 4, Section 9 of the BBAM 2014.

Within the development area HU860 was divided into three vegetation zones based on condition, regeneration, previous disturbance and species composition. One of these vegetation zones (HU860 Mod/Good_Other) represents an area that has undergone rehabilitation post-mining. This area of rehabilitation has been linked with the PCT HU860 as it is the closest equivalent vegetation type and was likely to be present in this area prior to mining. While the rehabilitation area contains canopy species that are not indicative of the PCT, for example *Eucalyptus parramattensis* subsp. *decadens* and *Eucalyptus camfieldii* (Camfield's Stringybark), indicative canopy species, such as *Angophora costata* (Smooth-barked Apple) and *Corymbia gummifera* (Red Bloodwood) are present. Additionally, the midstorey and ground stratum within this area are representative of the PCT, with species such as *Banksia serrata* (Old-man Banksia), *Acacia ulicifolia* (Prickly Moses) and *Pteridium esculentum* (Common Bracken). Details on each vegetation zone, including condition class, area and survey effort, is outlined in **Table 5**. Plot data has been provided in **Appendix 2**.

Figure 5 shows the distribution of PCTs and vegetation zones within the development site. It is noted that there are small areas of HU851 (0.04 ha) and HU938 (0.13 ha) which occur within the development site. As these areas are less than 0.25 ha (i.e. the minimum size for a vegetation zone, as stipulated by DECC (2008)), they have been amalgamated into the vegetation zone which they adjoin (i.e. HU860 Mod/Good for the small area of HU938, and HU860 Mod/Good_Other for the area of HU851).

Table 4: Descriptions of PCTs within the development site

HU860: Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	
Vegetation Class	Coastal Dune Dry Sclerophyll Forests
Area (ha)	40.38
Species used for Identification	Species used for ID (range of relative abundance (Ab) provided): *Angophora costata* (1 – 9) and *Corymbia gummifera* (1 – 20) in the canopy. *Banksia serrata* (2 – 100), *Monotoca elliptica* (20 – 100), *Macrozamia communis* (2 – 100) and *Acacia ulicifolia* (5 – 100) in the midstorey. *Pteridium esculentum* (3 – 1,000), *Hibbertia linearis* (1 – 50), *Dianella caerulea* (4 – 500), *Lomandra glauca* (5 – 100) *Pomax umbellata* (10 – 1000) in the ground stratum.
Justification for PCT selection	HU860 was determined as the closest equivalent PCT for this community within the development site. Comparison of floristic data indicates a very high similarity between this PCT and the community onsite, with the majority of species listed in the description for the community in the VIS recorded, including; *A. costata*, *C. gummifera, Eucalyptus pilularis* (although it is noted that this species is only present within rehabilitation areas), *B. serrata*, *M. elliptica, M. communis*, *A. ulicifolia, P. esculentum* and *D. caerulea.* The description for HU860 on the VIS database is also consistent with the location (Central and Lower North Coast) and landscape position of the vegetation within the development area (coastal flats and low rises and is confined to Quaternary dune sands at elevations up to 100 m). Within the Hunter Central Rivers CMA, there were four other PCTs within the Coastal Dune Dry Sclerophyll Forests Vegetation Class that are approved for use. These PCTs were deemed to be inconsistent with the vegetation within the development site due to the following: • HU832: low floristic similarity due to lack of *E. globoidea, E. resinifera* and *Allocasuarina torulosa* and *A. littoralis*. Also, landscape position is inconsistent (coastal valley flats and low coastal hills, mainly on sandy substrates); • HU851: low floristic similarity due to lack of *E. signata* as dominant canopy across the area of the PCT and the vegetation on site is dominated by *B. serrata* in the understorey, rather than *B. aemula*; • HU861: there is moderate floristic similarity between this PCT and the vegetation within the development site through the dominance of *C. gummifera, A. costata, P. esculentum* and *D. caerulea*. However, due to the low cover and abundance of *Leptospermum trinervium* and *L. polygalifolium,* and dominance of *B. serrata* within the vegetation in the development area HU860 was selected over HU861 (it is noted that *L. trinervium* dominates within the areas of Mod/Good_Other, however, this is likely to be attributed to historical rehabilitation. Areas not subject to rehabilitation generally had a low cover and abundance of *L. trinervium*); • HU862: there is a high floristic similarity between this PCT and the vegetation within the development site. However, this PCT is restricted to Quaternary sand lowlands in the Nelson Bay and Fingal Bay area (mostly within Tomaree NP). Another potential PCT considered was HU840. This PCT is within the Hunter-Macleay Dry Sclerophyll Forests Vegetation Class and has a moderate floristic similarity to the vegetation within the development site. However, this PCT was excluded due to the lack of *E. umbra, Pultenaea villosa* and *Doryanthes excelsa* within the development site, and the PCT is described as occurring in the Nelson Bay area.
EEC (TSC Act)	Not Listed – The VIS lists this PCT as *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* EEC. However, the vegetation within the development site is not consistent with the scientific determination for this EEC.
% Cleared within CMA	45%



Legend

- Subject Land (176.1 ha)
- Development Site Boundary (42.3 ha)
- Biobank Site Boundary (131.1 ha)
- Excluded Areas (2.7 ha)
- Quadrats

Metres
0 50 100 200 300 400 500
N

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DRAWN BY: gjoyce
DATA SOURCE:
NSW Land and Property Information - 2011
nearmap - 2016

Plant Community Types, Vegetation Zones and Plot Locations - Development Site

Williamtown Sand Syndicate
Offset Strategy
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE:
5

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Table 5: Vegetation Zones within the development site

Zone	PCT	Condition Class and Subcategory	Area	Survey Effort (Plots/ Transects)	
				Required	Conducted
1	HU860	Mod/Good_Other: This vegetation zone was assessed as moderate to good (other) as it has a modified structure and composition following past mining activities in comparison to vegetation zone 2. Examination of the plot/transect data collected within this zone indicates that this vegetation does not meet the definition of low condition as per the BBAM 2014. This vegetation zone contains 0.04 ha of HU851.	19.05	3	4
2	HU860	Mod/Good: Areas of remnant vegetation with minimal weeds or historical disturbance. This vegetation zone contains 0.13 ha of HU938	18.48	3	4
3	HU860	Mod/Good_Medium: This vegetation zone was assessed as moderate to good (medium) as it has a modified structure and composition following past clearing. These areas contain regenerating native vegetation, and have a higher proportion of weeds than Zone 2. Examination of the plot/transect data collected within this zone indicates that this vegetation does not meet the definition of low condition as per the BBAM 2014.	2.84	2	3

1.3.2.2 Biobank Site

Six PCTs were identified within the biobank site:

- HU917: Wallum Banksia-*Monotoca scoparia* heath on coastal sands of the Central Coast and lower North Coast;
- HU860: Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast;
- HU851: Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands;
- HU865: Parramatta red gum - Fern-leaved banksia - *Melaleuca sieberi* swamp woodland of the Tomaree Peninsula;
- HU938: Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast;

- HU948: Wallum Bottlebrush - *Leptocarpus tenax* - *Baloskion pallens* Wallum sedge heath of the lower North Coast.

The vegetation class, area within the biobank site, species used for identification, justification for the PCT selection, EEC status and percent cleared of the PCT is outlined in **Table 6**. One of the PCTs within the site was determined to constitute an EEC listed under the TSC Act 1995; HU938 within the biobank forms part of the *Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* EEC (NSW Scientific Committee (2004).

Small areas of cleared land (access tracks) occur within the biobank site, comprising a total area of 0.95 ha. These areas of cleared land do not constitute a PCT and were not assessed. These tracks will be maintained for access to the biobank.

A total of 10 vegetation zones were identified within the biobank. Both HU860 and HU938 were divided into three vegetation zones based on condition, regeneration, previous disturbance and species composition. All other PCTs within the biobank are represented by one vegetation zone. One of these vegetation zones (HU860 Mod/Good_Other) represents an area that has undergone rehabilitation post-mining. While this vegetation community contains species that are typical of HU860, rehabilitation efforts have introduced a number of other species that would not naturally occur within this vegetation type (e.g. *Eucalyptus parramattensis* subsp. *decadens* and *Eucalyptus camfieldii*). Details on each vegetation zone, including condition class, area and survey effort, is outlined in **Table 7**. **Figure 6** shows the distribution of PCTs and vegetation zones within the biobank site.

Table 6: Descriptions of PCTs within the biobank site

HU917: Wallum Banksia-Monotoca scoparia heath on coastal sands of the Central Coast and lower North Coast	
Vegetation Class	Coastal Hedland Heaths
Area (ha)	10.26
Species used for Identification	Species used for ID (range of relative abundance (Ab) provided): *Banksia aemula* (20 - 100), *Melaleuca nodosa* (20 – 100), *Leptospermum trinervium* (50 – 100), *Leptospermum polygalifolium* (20 – 50), *Monotoca scoparia* (10 - 50), *Amperea xiphoclada* (10 – 500) and *Leucopogon ericoides* (50 – 100) in the midstorey. *Hypolaena fastigiata* (10 - 100) and *Leptocarpus tenax* (50 – 500) in the ground stratum. The lack of a dominant canopy layer was indicative of this vegetation type.
Justification for PCT selection	HU917 was determined as the closest equivalent PCT for this community on the site. Comparison of floristic data indicates a very high similarity between this PCT and the community onsite, with the majority of species listed in the description for the community in the VIS recorded, including; *Banksia aemula*, *Melaleuca nodosa*, *Leptospermum trinervium*, *Leptospermum polygalifolium, Monotoca scoparia, Ricinocarpos pinifolius, Caustis recurvata, Hypolaena fastigiata and Lomandra glauca*. The description for HU917 is also consistent with the location (NSW North Coast) and landscape position of this community on the site (elevations below 100 m). All PCTs in the Hunter-Central Rivers CMA within the Heathlands vegetation formation were considered in undertaking the above determination. No other heathland PCTs were considered as potentially suitable due to substantially lower floristic similarity with vegetation within the biobank, compared to HU917. Additionally, other PCTs were not suitable due to landscape position (e.g. coastal headlands) and/or incorrect geographic location.
EEC (TSC Act)	Not Listed.
% Cleared within CMA	62%

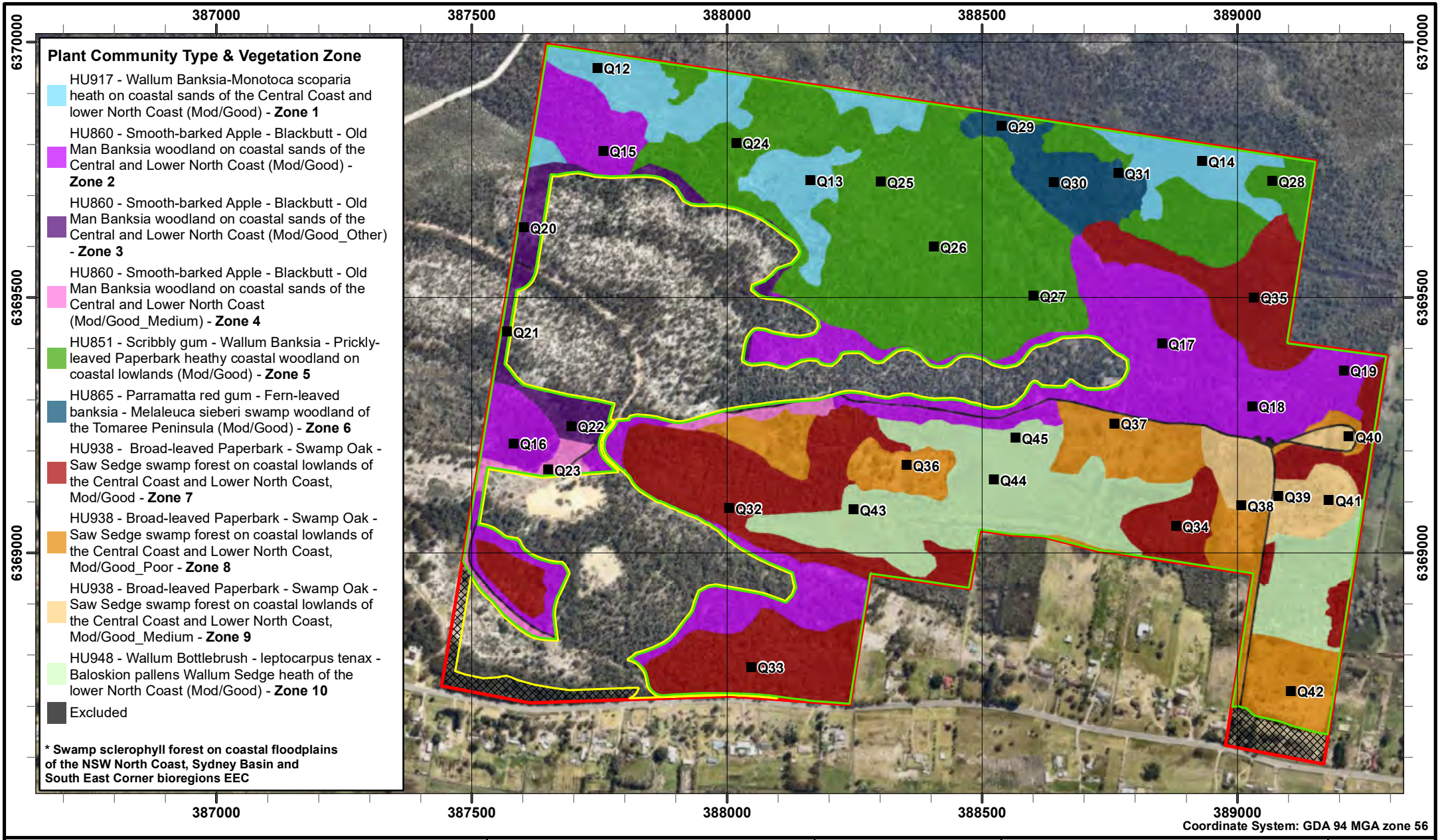
HU860: Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	
Vegetation Class	Coastal Dune Dry Sclerophyll Forests
Area (ha)	30.98
Species used for Identification	Species used for ID (range of relative abundance (Ab) provided): *Angophora costata* (1 – 50) and *Corymbia gummifera* (1 – 10) in the canopy. *Banksia serrata* (1 – 50), *Monotoca elliptica* (20 – 100) and *Acacia ulicifolia* (2 - 500) in the midstorey. *Pteridium esculentum* (5 – 1,000), *Hibbertia linearis* (5 – 50), *Dianella caerulea* (10 – 500), *Lomandra glauca* (10 – 100) *Pomax umbellata* (10 – 500) in the ground stratum.
Justification for PCT selection	HU860 was determined as the closest equivalent PCT for this community within the biobank site. Comparison of floristic data indicates a very high similarity between this PCT and the community onsite, with the majority of species listed in the description for the community in the VIS recorded, including; *A. costata*, *C. gummifera, Eucalyptus pilularis* (although it is noted that this species is only present within rehabilitation areas and one are of remnant forest), *B. serrata*, *M. elliptica, M. communis*, *A. ulicifolia, P. esculentum* and *D. caerulea.* The description for HU860 on the VIS database is also consistent with the location (Central and Lower North Coast) and landscape position of the vegetation within the biobank site (coastal flats and low rises and is confined to Quaternary dune sands at elevations up to 100 m). Within the Hunter Central Rivers CMA, there were four other PCTs within the Coastal Dune Dry Sclerophyll Forests Vegetation Class that are approved for use. These PCTs were deemed to be inconsistent with the vegetation within the biobank site due to the following: • HU832: low floristic similarity due to lack of *E. globoidea, E. resinifera* and *Allocasuarina torulosa* and *A. littoralis*. Also, landscape position is inconsistent (coastal valley flats and low coastal hills, mainly on sandy substrates); • HU851: low floristic similarity due to lack of *E. signata* as dominant canopy across the area of the PCT and the vegetation on site is dominated by *B. serrata* in the understorey, rather than *B. aemula*; • HU861: there is moderate floristic similarity between this PCT and the vegetation within the biobank site through the dominance of *C. gummifera, A. costata, P. esculentum* and *D. caerulea*. However, due to the low cover and abundance of *Leptospermum trinervium* and *L. polygalifolium,* and dominance of *B. serrata* within the vegetation in the biobank area HU860 was selected over HU861 (it is noted that *L. trinervium* dominates within the areas of Mod/Good_Other, however, this is likely to be attributed to historical rehabilitation. Areas not subject to rehabilitation generally had a low cover and abundance of *L. trinervium*); • HU862: there is a high floristic similarity between this PCT and the vegetation within the biobank site. However, this PCT is restricted to Quaternary sand lowlands in the Nelson Bay and Fingal Bay area (mostly within Tomaree NP). Another potential PCT considered was HU840. This PCT is within the Hunter-Macleay Dry Sclerophyll Forests Vegetation Class and has a moderate floristic similarity to the vegetation within the biobank site. However, this PCT was excluded due to the lack of *E. umbra, Pultenaea villosa* and *Doryanthes excelsa* within the biobank site, and the PCT is described as occurring in the Nelson Bay area.
EEC (TSC Act)	Not Listed – The VIS lists this PCT as *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* EEC. However, the vegetation within the biobank site is not consistent with the scientific determination for this EEC.
% Cleared within CMA	45%

HU851: Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands	
Vegetation Class	Coastal Dune Dry Sclerophyll Forests
Area (ha)	29.91
Species used for Identification	Species used for ID (range of relative abundance (Ab) provided): *Eucalyptus signata* (2 – 20) in the canopy. *Banksia aemula* (20 – 100), *Leptospermum trinervium* (10 – 100), *Leptospermum polygalifolium* (10 – 100), *Melaleuca nodosa* (20 – 100), *Isopogon anemonifolius* (5 – 20) and *Bossiaea heterophylla* (5 – 100) in the midstorey. *Platysace ericoides* (10 – 100) and *Eriostemon australis* (5- 20) in the ground stratum.
Justification for PCT selection	HU851 was determined as the closest equivalent PCT for this community on the biobank site. Comparison of floristic data indicates a very high similarity between this PCT and the community onsite, with the majority of species listed in the description for the community in the VIS recorded, including; *E. signata, B. aemula, L. trinervium, L. polygalifolium, M. nodosa, I. anemonifolius B. heterophylla, Xanthorrhoea glauca, P. ericoides, E. australis* and *Leucopogon leptospermoides*. The description for HU851 is also consistent with the location (NSW North Coast) and landscape position of this community on the site (i.e. confined to the Tomago Sandbeds in the Williamtown to Salt Ash area; the dominant substrate is sand and general elevation is less than 100 m). Within the Hunter Central Rivers CMA, there were four other PCTs within the Coastal Dune Dry Sclerophyll Forests Vegetation Class that are approved for use (HU832, HU860, 861 and HU862). These PCTs were deemed to be inconsistent with the vegetation within the biobank site due to a lack of floristic similarities. The other PCTs in this Vegetation Class are not dominated by *E. signata* and are not described as containing a heathy understorey. HU861 has some floristic similarities but does not include *B. aemula* which one of the dominant understorey species of this community within the biobank site. HU917 has a high floristic similarity to this community (e.g. *B. aemula, M. nodosa* and *L. trinervium*) but the vegetation on site has a eucalypt canopy component and as such is more closely aligned to a heathy woodland rather than a heath vegetation structure.
EEC (TSC Act)	Not Listed
% Cleared within CMA	42%

HU865: Parramatta red gum - Fern-leaved banksia - Melaleuca sieberi swamp woodland of the Tomaree Peninsula	
Vegetation Class	Coastal Floodplain Wetlands
Area (ha)	3.75
Species used for Identification	Species used for ID (range of relative abundance (Ab) provided): *Eucalyptus parramattensis* subsp. *decadens* (5 – 20) in the canopy. *Melaleuca thymifolia* (20 – 100), *Banksia oblongifolia* (3 – 100), *Leptospermum polygalifolium* (3 – 50), *Leptospermum arachnoides* (50 – 100), *Callistemon pachyphyllus* (3) and *Acacia longifolia* (5 – 10) in the midstorey. *Leptocarpus tenax* (100 - 1000), *Schoenus brevifolius* (5 – 1000) *and Lepyrodia scariosa* (50 – 1000) in the ground stratum.
Justification for PCT selection	HU865 was determined as the closest equivalent PCT for this community on the site. Comparison of floristic data indicates a high similarity between this PCT and the community onsite, with the majority of diagnostic species listed in the VIS for HU865 recorded, including; *E. parramattensis* subsp. *decadens, M. thymifolia, M. sieberi, B. oblongifolia, L. polygalifolium, C. pachyphyllus, Hakea teretifolia, L. tenax, S. brevifolius, L. scariosa* and *Entolasia stricta*. The location description for HU865 is also consistent with the biobank, NSW North Coast. However, the landscape position of this PCT lists it as being restricted to the Tomaree Sandbeds. As the only one other PCT approved for use within the Hunter-Central Rivers CMA that has *E. parramattensis* subsp. *decadens* as a diagnostic species is confined to the Cessnock-Kurri Kurri area (HU847), HU865 is considered to be the most closely aligned approved PCT.
EEC (TSC Act)	Not Listed
% Cleared within CMA	75%

HU938: Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast	
Vegetation Class	Coastal Swamp Forest
Area (ha)	40.13
Species used for Identification	Species used for ID (range of relative abundance (Ab) provided): *Eucalyptus robusta* (2 – 50) and *Melaleuca quinquenervia* (3 – 50) in the overstorey. *Acacia longifolia* (2 – 500) in the midstorey. *Gahnia clarkei* (1 – 50), *Blechnum indicum* (50 - 500) and *Dianella caerulea* (20 - 50).
Justification for PCT selection	HU938 was determined as the closest equivalent PCT for this community on the site. Comparison of floristic data indicates a very high similarity between this PCT and the community onsite, with the majority of diagnostic species listed in the VIS for HU938 recorded, including; *E. robusta, M. quinquenervia*, *Casuarina glauca, A. longifolia, G. clarkei, B. indicum, Baumea articulata* and *D. caerulea*. The description for HU938 is also consistent with the location (NSW North Coast) and landscape position of this community on the site (i.e. alluvial sands and muds on floodplains and barrier sands at elevations from 1 to 350 m). Within the Hunter Central Rivers CMA, there were several other PCTs within the Coastal Swamp Forest Vegetation Class, that were considered when undertaking the PCT determination (only PCTs approved for use were considered): • Both HU931 and HU935 have a relatively high floristic similarity with the vegetation within the biobank site. However, both of these communities were excluded based on location; the core distribution of HU931 is Broadwater to Failford, and HU935 is described as occurring on the southern shores of Lake Macquarie; • HU939 was considered to be the next closest equivalent to HU938 as both have similar floristics and landscape characteristics. HU939 was not selected as this PCT is not described as occurring within the Sydney – Newcastle Barriers and Beaches Mitchell Landscape on the VIS database. HU939 is described as occurring in Mitchell Landscapes that occur further north (e.g. Manning Macleay Barriers and Beachs and Myall River Channel and Floodplains). This is not consistent with the location of the biobank site which occurs within the Sydney – Newcastle Barriers and Beaches Mitchell Landscape, which is listed in the description for HU938.
EEC (TSC Act)	This vegetation community forms part of the *Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* EEC.
% Cleared within CMA	31%

HU948: Wallum Bottlebrush - Leptocarpus tenax - Baloskion pallens Wallum sedge heath of the lower North Coast	
Vegetation Class	Coastal Heath Swamps
Area (ha)	15.10
Species used for Identification	Species used for ID (range of relative abundance (Ab) provided): *Melaleuca quinquenervia* (10), *Hakea teretifolia* (5), *Callistemon citrinus* (5 – 100) and *Leptospermum juniperinum* (3 – 100) in the midstorey. *Schoenus brevifolius* (20), *Entolasia stricta* (20 – 500), *Baumea teretifolia* (50) and *Leptocarpus tenax* (5).
Justification for PCT selection	HU948 was determined as the closest equivalent PCT for this community on the site. Comparison of floristic data indicates a high similarity between this PCT and the community onsite, with the majority of diagnostic species listed in the VIS for HU948 recorded, including; *M. quinquenervia, H. teretifolia, L. tenax, S. brevifolius, E. stricta* and *B. teretifolia*. The description for HU948 is also consistent with the vegetation structure (Swampy Tall Shrublands), location (NSW North Coast) and landscape position (low-lying poorly drained coastal sites from Salt Ash to Crowdy Bay NP, on substrates that are mainly sands and at elevation under 15 m) of this community on the site. It is noted that the biobank does not occur within the core area of this PCT's distribution (i.e. from Salt Ash to Crowdy Bay NP); however, the biobank is approximately 6 – 7 km west of the Salt Ash area. Within the Hunter Central Rivers CMA, there were four other PCTs within the Coastal Heath Swamps Vegetation Class that are approved for use. These PCTs were deemed to be inconsistent with the vegetation within the biobank site due to the following: • HU918: The structure and landscape position of HU918 is consistent with the biobank (i.e. tall dense shrublands dominated by myrtaceous shrubs, occurring on Quaternary sands and muds at elevations under 30 m). However, the floristic similarity of this PCT compared to the vegetation within the biobank is low (e.g. lack of *Banksia oblongifolia, Leptospermum polygalifolium, Melaleuca nodosa, B. aemula* and *Dillwynia retorta*); • HU913 and HU921: incorrect distribution and landscape position (Hawksbury Sandstone at elevations of up to 300 m); • HU953: there is low floristic similarity between this PCT and the vegetation on-site (PCT dominated by *Sporobolus virginicus, Philydrum lanuginosum* and *Persicaria* sp.) and the structural description (Freshwater wetlands dominated by Sporobolus and Philydrum with emergent Melaleucas) is inconsistent with the dense tall swampy shrubland that is present on-site. Another potential PCT considered was HU920. This PCT is within the Wallum Sand Heaths Vegetation Class and is consistent with the structure and landscape position of the vegetation within the biobank site (i.e. tall wet shurbland dominated by Myrtaceous shrubs, the ground stratum is typically wet and the community occurs on coastal and sub-coastal Quaternary sands at elevations up to 10 m). While there are similarities between the presence of *Callistemon citrinus* in both the vegetation at the biobank and the PCT, generally there was low floristic similarity between the two due to the lack of *Leptospermum liversidgei, Xanthorrhoea fulva, Sprengelia sprengelioides, Epacris microphylla and Sporadanthus interruptus* within the biobank site.
EEC (TSC Act)	Not Listed.
% Cleared within CMA	44%



Legend

- Subject Land (176.1 ha)
- Biobank Site Boundary (131.1 ha)
- Development Site Boundary (42.3 ha)
- Excluded Areas (2.7 ha)
- Quadrats

Metres
0 50 100 200 300 400 500
N

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DATE DRAWN: 13/10/2016 17:42 Version 1
DRAWN BY: gjoyce
DATA SOURCE:
NSW Land and Property Information - 2011
nearmap - 2016

Plant Community Types, Vegetation Zones and Plot Locations - Biobank Site

Williamtown Sand Syndicate
Offset Strategy
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE:
6

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Table 7: Vegetation zones within the biobank site

Zone	PCT	Condition Class and Subcategory	Area	Survey Effort (Plots/ Transects)	
				Required	Conducted
1	HU917	Mod/Good: Areas of remnant vegetation with minimal weeds or historical disturbance.	10.26	3	3
2	HU860	Mod/Good: Areas of remnant vegetation with minimal weeds or historical disturbance.	25.65	4	5
3	HU860	Mod/Good_Other: This vegetation zone was assessed as moderate to good (other) as it has a modified structure and composition following past mining activities in comparison to vegetation zone 2. Examination of the plot/transect data collected within this zone indicates that this vegetation does not meet the definition of low condition as per the BBAM 2014.	3.60	2	3
4	HU860	Mod/Good_Medium: This vegetation zone was assessed as moderate to good (medium) as it has a modified structure and composition following past clearing. These areas contain regenerating native vegetation, and have a higher proportion of weeds than Zone 2. Examination of the plot/transect data collected within this zone indicates that this vegetation does not meet the definition of low condition as per the BBAM 2014.	1.73	1	1
5	HU851	Mod/Good: Areas of remnant vegetation with minimal weeds or historical disturbance.	29.91	4	5
6	HU865	Mod/Good: Areas of remnant vegetation with minimal weeds. Some historical disturbance has occurred within this zone, however, the vegetation is in moderate to good condition.	3.75	2	3
7	HU938	Mod/Good: Areas of remnant vegetation with minimal weeds or historical disturbance.	24.58	4	4
8	HU938	Mod/Good_Poor: This vegetation zone was assessed as moderate to good (poor) as it has a modified structure and composition following past disturbance. These areas contain regenerating native vegetation, however the canopy cover is below benchmark. This vegetation zone also has a high proportion of weed cover than Zone 7. Examination of the plot/transect data collected within this zone indicates that this vegetation does not meet the definition of low condition as per the BBAM 2014.	11.57	3	3

Zone	PCT	Condition Class and Subcategory	Area	Survey Effort (Plots/ Transects)	
				Required	Conducted
9	HU938	Mod/Good_Medium: This vegetation zone was assessed as moderate to good (medium) as it has a modified structure and composition following past disturbance. These areas contain regenerating native vegetation. While the canopy cover is less than Zone 7, the canopy cover is within benchmark. This vegetation zone also has a high proportion of weed cover than Zone 7. Examination of the plot/transect data collected within this zone indicates that this vegetation does not meet the definition of low condition as per the BBAM 2014.	3.98	2	4
10	HU948	Mod/Good: Areas of remnant vegetation with minimal weeds or historical disturbance.	15.10	3	3

1.4 THREATENED SPECIES

1.4.1 Ecosystem Credit Species

Predicted ecosystem and species credits for the development and biobank sites were identified and assessed in accordance with Section 6.3 of the BBAM 2014. No ecosystem credit species were excluded from the predicted species list or had their offset multiplier modified for the assessment.

1.4.2 Species Credit Species

Species credit species requiring targeted surveys were determined in accordance within Section 6.5 of the BBAM 2014. Subsequent surveys were undertaken in accordance with Section 6.6 of the BBAM 2014. Further details of the surveys conducted within the development and biobank sites is provided in the Environmental Impact Assessment: Proposed Sand Quarry, Cabbage Tree Road Summary Report (Kleinfelder 2016).

1.4.2.1 Methodology: Field Surveys

Flora

Targeted searches for threatened flora species were undertaken by Umwelt in 2013, 2014 and 2015, and RPS in 2011 in accordance with the *Threatened biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004). Targeted searches were undertaken along numerous walking/meandering transects within suitable habitat for target species.

The location of all threatened flora species were recorded using a hand-held GPS and where relevant, details on the habit, height and plant number was also recorded. Additionally, voucher specimens were collected and lodged with the Herbarium of Australia, Royal Botanic Gardens Sydney.

Fauna

Field surveys for fauna species credit species were conducted by Umwelt in 2013, 2015 and 2015 and RPS in 2011 in accordance with the *Threatened biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004).

Three fauna species credit species were identified during these surveys:

- Eastern Osprey (*Pandion cristatus*): one individual was observed by RPS in 2011 roosting within an *Angophora costata* (Smooth-barked Apple) in the west of the Subject Land and a potential nest was identified (the nest was not occupied at the time of survey). The species was assessed as utilising all available habitat within the Subject Land (development site and biobank site);
- Koala (*Phascolarctos cinereus*): one individual was recorded by RPS in 2011 in the south of the Subject Land, within the area of HU938 along Cabbage Tree Road. The species was assessed as utilising all areas of potential habitat within the Subject Land (development site and biobank site), due to the high number of records of the species within and surrounding the Subject Land. There are a total of 9 Atlas records within the Subject Land; one from 2011 (accuracy of 10 m), one from 2008 (accuracy of 1,000 m) and the remaining seven in 1992 or prior (all accuracy of 1,000 m). Additionally, there are 37 records within 1 km of the Subject Land, of which five are within the last 10 years; and
- Wallum Froglet (*Crinia tinnula*): the species was recoded within the Subject Land during surveys conducted by Umwelt and RPS. The species was assessed as utilising all available habitat within the Subject Land (development site and biobank).

The methods for mapping habitat for each of these species is outlined in the following section.

1.4.2.2 Methodology: Fauna Habitat Mapping

Habitat mapping for each of the species credit species identified within the Subject Land was conducted by Kleinfelder based on updated vegetation mapping conduct in May – August 2016.

Eastern Osprey

The Eastern Osprey was observed to be roosting in an *Angophora costata* (Smooth-barked Apple) in the west of the Subject Land.

Roosting and nesting habitat for the eastern Osprey was defined as emergent living and dead trees within 3 km of foraging habitat at Fullerton Cove. Foraging habitat consists of open water.

Koala

The extent and quality of Koala habitat within the Subject Land was determined using the methodology described in *Appendix 6 - Guidelines for Koala Habitat Assessments* of the *Port Stephens Council Comprehensive Koala Plan of Management* (CKPoM) (PSC 2002). The Koala Habitat Assessment is undertaken in four major parts:

1. **Preliminary Assessment:** examination of the Koala Habitat Planning Map of the Port Stephens LGA to determine mapped Koala Habitat and undertake an inspection of the site to determine whether it contains individuals of preferred Koala feed trees (**Table 7**) outside areas mapped as Preferred Koala Habitat.
2. **Vegetation Mapping**: mapping vegetation types across the study area using aerial photography and detailed ground-truthing. Floristic and structural characteristics of each vegetation community was determined using plot-based survey methods.
3. **Koala Habitat Identification:** If the LGA-wide Koala habitat map produced by PSC is inaccurate for the site, a revised map must be developed in accordance with the Koala habitat categories defined in the CKPoM. If it is identified that the site contains either preferred or supplementary Koala habitat, habitat buffers or Habitat linking areas then proceed to Step 4.
4. **Assessment of Proposal:** At this point, a map needs to be produced showing information gathered in Steps 1, 2 and 3 and showing the proposed development. The appropriateness of the proposal is assessed using performance criteria from Appendix 4 of the CKPoM. This has been conducted as part of the Ecological Impact Assessment, and is detailed in the Environmental Impact Assessment: Proposed Sand Quarry, Cabbage Tree Road Summary Report (Kleinfelder 2016). For this offset strategy, the key canopy species used to determine the category of habitat within the Subject Land is provided in **Section 1.4.2.3**.

Table 8: List of preferred Koala feed trees in the Port Stephens LGA.

Scientific Name	Common Name
Eucalyptus robusta	Swamp Mahogany
Eucalyptus tereticornis	Forest Red Gum
Eucalyptus parramattensis	Earp's Gum

Wallum Froglet

Breeding breeding habitat for the Wallum Froglet was defined as low lying areas that contain permanent water or ephemeral pools; this included HU938 and HU948. Foraging habitat was defined as low lying areas (less than 5 m in elevation) that occur within 200 m of breeding habitat, that contains a dense ground stratum, including low shrubs, herbs grasses or sedges, or areas that have substantial leaf litter and woody debris.

1.4.2.3 Assessment Results

Eucalyptus camfieldii

A total of 1,868 *Eucalyptus camfieldii* were identified within the Subject Land, 227 within the development site and 1,641 within the biobank (**Figure 7**).

Within the development site the majority of the individuals occur within HU860 Mod/Good_other. This area has been subject to rehabilitation post heavy mineral sand mining, it is highly unlikely that the species would have present in this area prior to rehabilitation. Only a few individuals were identified within HU860 Mod/Good, these individuals occur at elevations below 9 m in areas which are co-dominated by *Eucalyptus piperita* (Sydney Peppermint).

Within the biobank the majority of individuals occur within HU851 and HU917, with a few individuals occurring within HU860, again in areas co-dominated by *E. piperita*, and also typically where *Melaleuca nodosa* (Prickly-leaved Paperbark) occurs.

Eucalyptus camfieldii is a mallee tree and can sucker, as such where groups of stems occur, they were defined as one individuals. Typically the separation distance between stems of separate individuals was defined as >1 m, however, where it was obvious that stems were connected (i.e. visible roots or lignotubers), stems >1 m apart were counted as an individual.

Eucalyptus parramattensis subsp. *decadens*

A total of 864 *E. parramattensis* subsp. *decadens* occur within the Subject Land, 230 within the development site and 634 within the biobank (**Figure 8**).

Within the development site all individuals were recorded within HU860 Mod/Good_other. This area has been subject to rehabilitation post heavy mineral sand mining. It is highly unlikely that the species would have present in this area prior to rehabilitation as it does not represent potential habitat for the species, due to the elevation of this area. The naturally occurring population of the species on site occurs in lower lying area subject to periodic inundation. As such it is likely that all individuals have been planted or seeded into this area during rehabilitation works.

Within the biobank site the species is primarily located in the north west of the biobank site with a large proportion occurring within HU865. Individuals also occur in HU851, HU917 and HU938.

Grevillea parviflora subsp. *parviflora*

A total of 102 individuals of *Grevillea parviflora* subsp. *parviflora* occur within north-east of the biobank site (**Figure 9**). Individual occur within HU865 and HU851.

Eastern Osprey

A total of 40.38 ha of roosting and nesting habitat for the Eastern Osprey was identified within the development site (**Figure 10**). Habitat for the species was identified in HU860 due to the presence of a tall canopy layer, and all areas occur within 3 km of Fullerton Cove.

A total of 101.02 ha of roosting and nesting habitat for the Eastern Osprey was identified within the biobank site (**Figure 10**). Habitat for the species was identified in HU860, HU851 and HU938 as these areas contain a tall canopy layer, and all areas occur within 3 km of Fullerton Cove. The area of habitat for the species includes area of regenerating HU938 within Zone 8 of the biobank site, as canopy trees are present within this zone and it will be further developed through management actions (see **Section 3.1.3.1**).

Koala

Koala habitat for the purposes of credit calculations for the development and biobank sites, has been defined as both 'Preferred' and 'Supplementary' Koala habitat as defined in the Port Stephens Council CKPoM (PSC 2002).

Development Site

A total of 40.38 ha of Koala habitat was identified within areas of HU860 of the development site, as these areas represent either Preferred Koala Habitat or Supplementary Koala Habitat (**Figure 11**).

HU860 Mod/Good_other (Zone 1) was defined as Preferred Koala habitat due to the presence of and *E. signata,* which classifies this vegetation as Category B, as defined by Lunney *et al*. (1998); Tall Open Blackbutt and Sydney Red Gum Forest with Scribbly Gum. Additionally, this zone contains *E. parramattensis* subsp. *decadens* which is a preferred Koala feed tree in Port Stephens.

HU860 Mod/Good and HU860 Mod/Good_Medium (Zones 2 and 3) were defined as Supplementary Koala Habitat as the vegetation is consistent with Category C Vegetation Associations, as defined by Lunney *et al*. (1998); Tall Open Blackbutt and Sydney Red Gum Forests.

Biobank Site

A total of 104.78 ha of Koala habitat was identified within areas all areas of HU860 (Zones 2, 3 and 4), HU851 (Zone 5), HU938 (Zones 7, 8 and 9) and HU865 (Zone 1), as these areas represent either Preferred Koala Habitat Supplementary Koala Habitat (**Figure 11**).

HU938 (Zones 7, 8 and 9) were defined as Preferred Koala habitat due to the dominance of *E. robusta,* which classifies this vegetation as Category A, as defined by Lunney et al. (1998); Open Swamp Mahogany Forests. The area of regenerating HU938 (Zone 8) of the biobank site was included, as canopy trees are present within this zone and it will be further developed through management actions (see **Section 3.1.3.1**).

HU860 Mod/Good_Other (Zone 3) and HU851 (Zone 5) were defined as Preferred Koala habitat due to the presence of and *E. signata*, which classifies this vegetation as Category B, as defined by Lunney et al. (1998); Tall Open Blackbutt and Sydney Red Gum Forest with Scribbly Gum. Additionally, HU860 Mod/Good_Other (Zone 3) contains *E. parramattensis* subsp. *decadens* which is a preferred Koala feed tree in Port Stephens. An area of Vegetation HU860 (Zone 2) in the west of the biobank is also classified as Preferred Koala Habitat due to the co-dominance of *E. signata* (area represented by Quadrat 17; **Figure 6**).

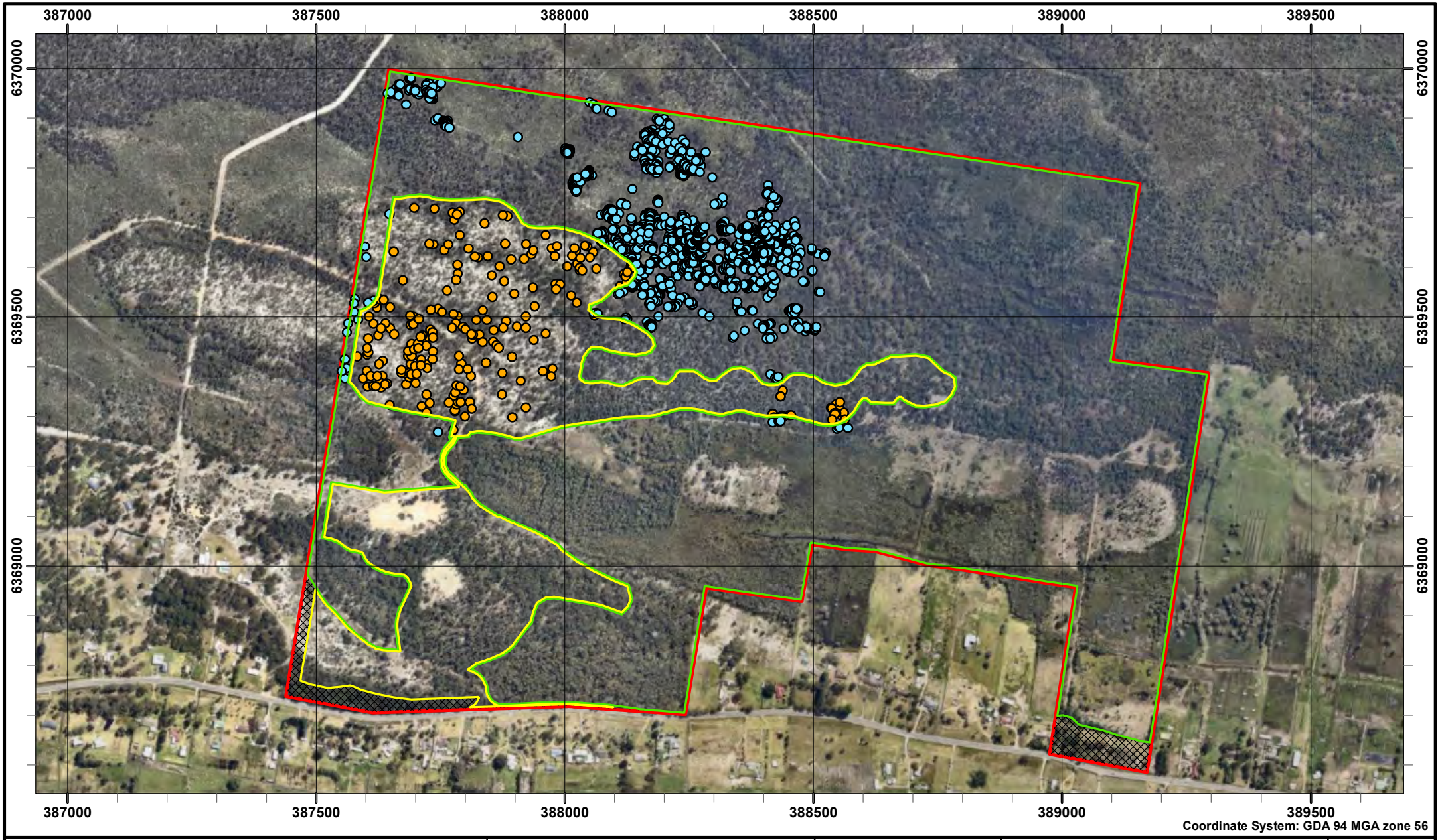
HU865 (Zone 6) was identified as Preferred Koala Habitat due to the dominance of *E. parramattensis* subsp. *decadens* which is a preferred Koala feed tree in Port Stephens

HU860 Mod (Zones 2 and 4) were defined as Supplementary Koala Habitat as the vegetation is consistent with Category C Vegetation Associations, as defined by Lunney et al. (1998); Tall Open Blackbutt and Sydney Red Gum Forests.

Wallum Froglet

A total of 0.71 ha of suitable habitat for the Wallum Froglet was identified within the development site (**Figure 12**). A small area of HU938 occurs within the very southern portion of the development site, along Cabbage Tree Road (included within Zone 2). This area represents breeding habitat for the species due to the presence of wet areas with dense understorey vegetation. Additionally, small low lying areas of HU860 which occur below 5 m elevation occur within the development site. As these areas occur adjacent to breeding habitat and contain a dense understorey, they represent foraging habitat.

Within the biobank a total of 85.39 ha of breeding and foraging habitat were identified.



Legend

- Subject Land (176.1 ha)
- Development Site Boundary (42.3 ha)
- Biobank Site Boundary (131.1 ha)
- Excluded Areas (2.7 ha)

***E. camfieldii* Locations**

- Within Development Site (227 individuals)
- Within Biobank Site (1,641 individuals)

Metres
0 50 100 200 300 400 500
N

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E. camfieldii Locations - Development Site & Biobank Site

Williamtown Sand Syndicate
Offset Strategy
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE:
7

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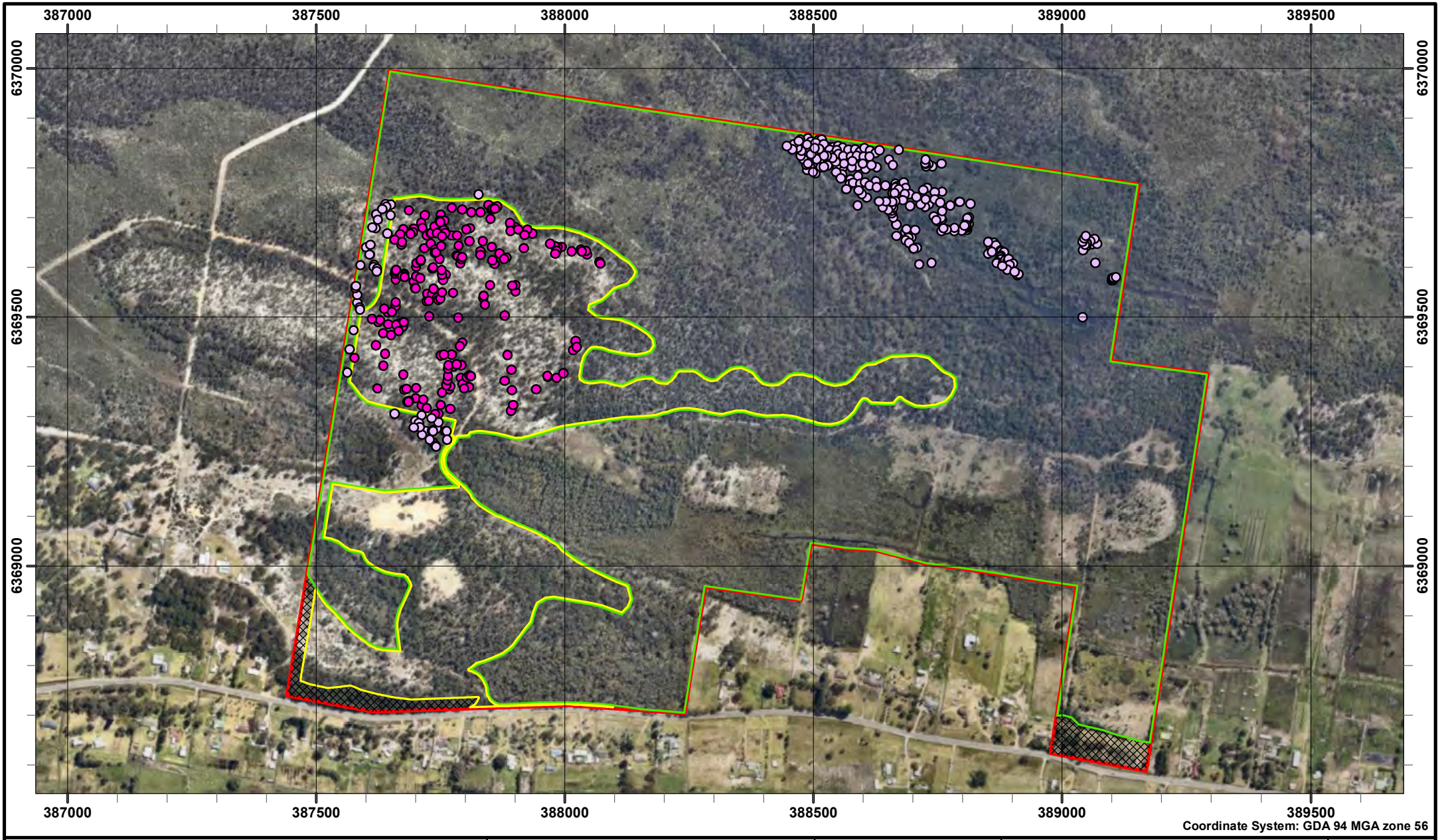

Legend

- Subject Land (176.1 ha)
- Biobank Site Boundary (131.1 ha)
- Development Site Boundary (42.3 ha)
- Excluded Areas (2.7 ha)

***E. parramattensis* Locations (UMWELT 2013-15 and RPS 2011)**

- Within Development Site (230 individuals)
- Within Biobank Site (634 individuals)

Metres
0 50 100 200 300 400 500
N

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E. parramattensis Locations - Development Site & Biobank Site

Williamtown Sand Syndicate
Offset Strategy
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE:
8

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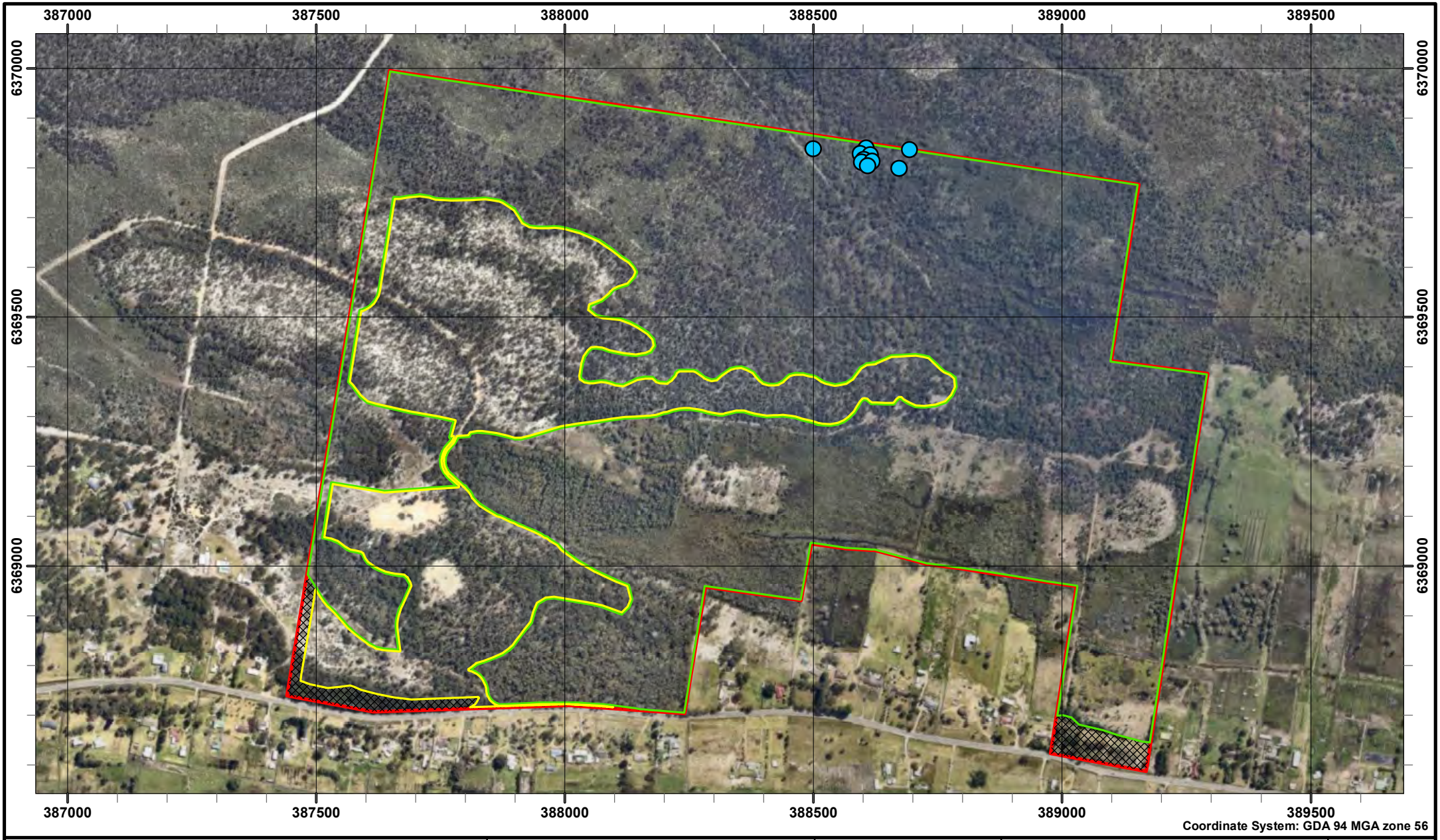

Legend

- Subject Land (176.1 ha)
- Biobank Site Boundary (131.1 ha)
- Development Site Boundary (42.3 ha)
- Excluded Areas (2.7 ha)
- *G. parviflora* Locations (102 individuals - RPS 2011 and Umwelt 2015)

Metres
0 50 100 200 300 400 500
N

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G. parviflora Locations - Development Site & Biobank Site

Williamtown Sand Syndicate
Offset Strategy
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE:
9

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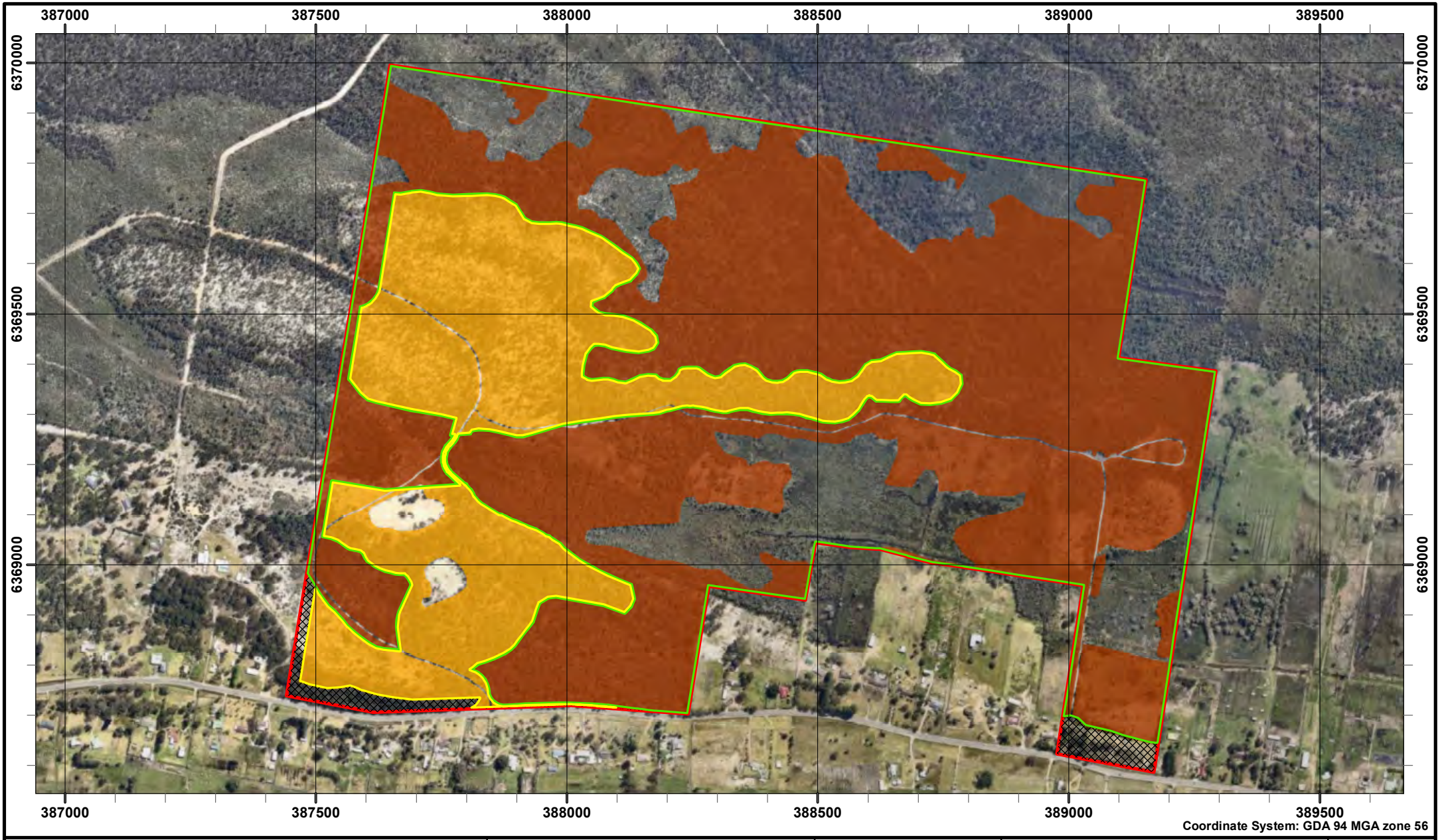

Legend

- Subject Land (176.1 ha)
- Biobank Site Boundary (131.1 ha)
- Development Site Boundary (42.3 ha)
- Excluded Areas (2.7 ha)

Eastern Osprey Habitat

- Within Development Site (40.4 ha)
- Within Biobank Site (101.0 ha)

Metres
0 50 100 200 300 400 500
N

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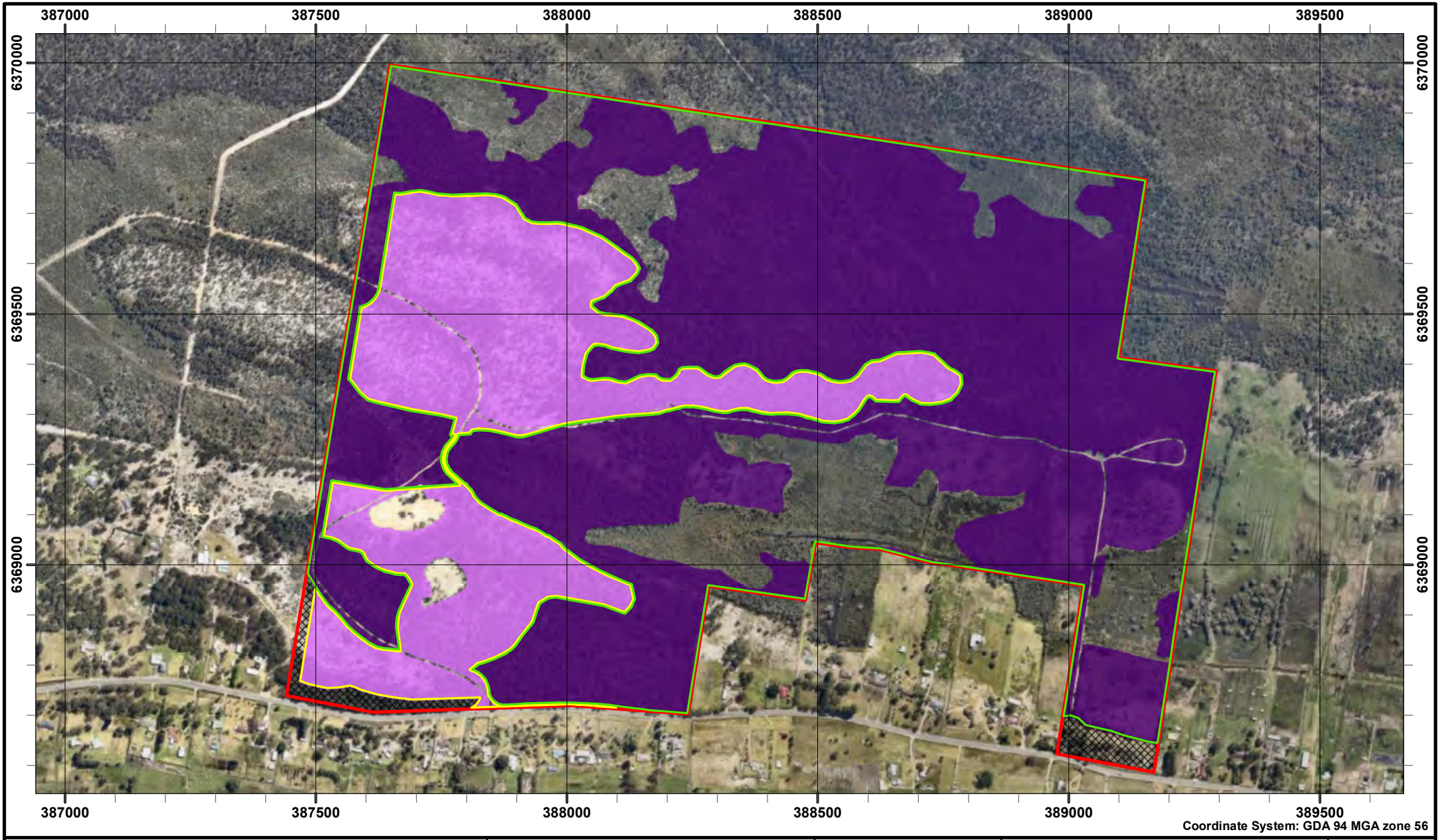
Port Stephens Council - 2000
nearmap - 2016

Eastern Osprey Development Site & Biobank Site

Williamtown Sand Syndicate
Offset Strategy
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE: 10

L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_OS_Fig10_EasternOsprey.mxd



Legend

- Subject Land (176.1 ha)
- Biobank Site Boundary (131.1 ha)
- Development Site Boundary (42.3 ha)
- Excluded Areas (2.7 ha)

Koala Habitat

- Within Development Site (40.38 ha)
- Within Biobank Site (104.78 ha)

Metres

0 50 100 200 300 400 500

N

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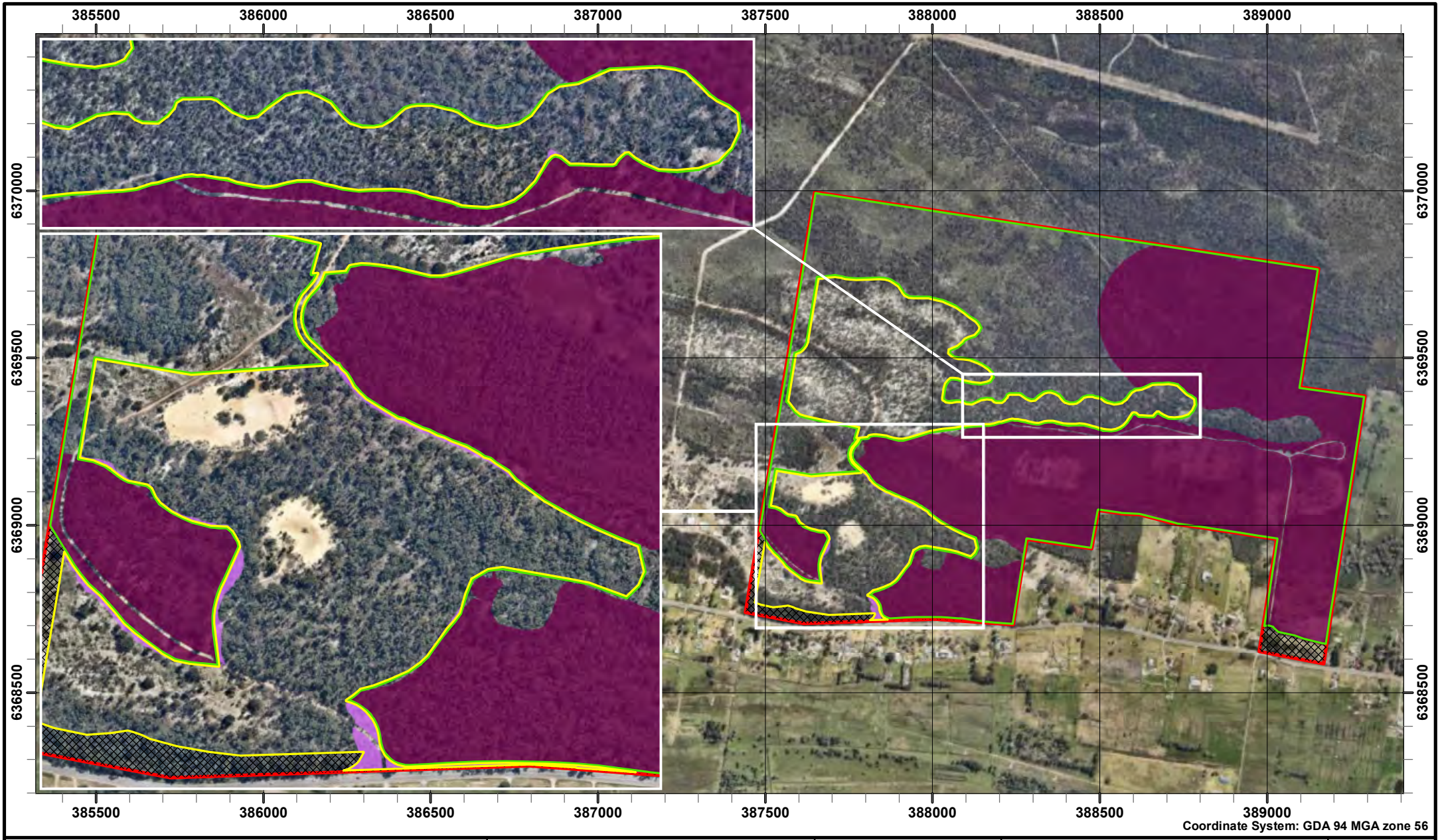
Koala Habitat
Development Site & Biobank Site

Williamtown Sand Syndicate
Offset Strategy
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE:

11

L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_OS_Fig11_Koala.mxd



Legend

- Subject Land (176.1 ha)
- Biobank Site Boundary (131.1 ha)
- Development Site Boundary (42.3 ha)
- Excluded Areas (2.7 ha)

Wallum Froglet (*Crinia tinnula*) Habitat

- Within Development Site (0.7 ha)
- Within Biobank Site (85.4 ha)

Metres
0 50 100 200 300 400 500

N

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Wallum Froglet Habitat Development Site & Biobank Site

Williamtown Sand Syndicate
Offset Strategy
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE:
12

L:\GIS FOLDER\00 CLIENT FILES\126863_TrusteeForWSS_UnitTrust\20170448_Williamtown\Mapping\20170448_OS_Fig12_WallumFroglet.mxd

STAGE 2: IMPACT ASSESSMENT

2.1 AVOID AND MINIMISE IMPACTS

In response to submissions from authorities and the community, regarding the Environmental Impact Statement (EIS) (Umwelt 2015), WSS has redesigned the original development footprint to avoid important ecological features. The impact area has been reduced by 11.65 ha, from 53.9 ha to 42.25 ha (approximately 22%).

This revised extraction area has resulted in a reduction in the impact on native vegetation within the development site (22% reduction in native vegetation impacts). In-turn this reduction on native vegetation, has also reduced impacts on threatened species habitat, including habitat for the Eastern Osprey, Koala and Wallum Froglet, and also reduced the removal of hollow-bearing trees from the area which provide refuge for a number of species. Additionally, the revised extraction area has reduced the impact on *E. parramattensis* subsp. *decadens* from 284 to 230 individuals (19% reduction).

In order to minimise impacts on the retained vegetation and locally occurring threatened species within the Subject Land, a Biodiversity Management Plan will be prepared for the development. The plan will detail mechanisms to mitigate impacts during the operation of the quarry, the following will be addressed:

- Measures for pre-clearance surveys;
- Hollow bearing tree inspection and felling procedures;
- Nest box installation and monitoring;
- Weed control;
- Pest management;
- Erosion and sedimentation control;
- Water management;
- Noise mitigation;
- Air quality; and
- Detailed rehabilitation strategy for the disturbance area, including:
    - Staged rehabilitation;
    - Topsoil stockpiling and spreading;

- Use of locally endemic species, including the threatened species, *Eucalyptus camfieldii;* and
- Monitoring.

Further details on avoidance and impact mitigation measures are outlined in the Environmental Impact Assessment: Proposed Sand Quarry, Cabbage Tree Road - Summary Report (Kleinfelder 2016).

2.2 IMPACT SUMMARY

2.2.1 Red Flags

As this is an offset strategy, not an application for a biobanking statement, red flags are not applicable. Impacts on threatened species have been assessed as part of the Environmental Impact Assessment and are outlined in the Environmental Impact Assessment: Proposed Sand Quarry, Cabbage Tree Road Summary Report (Kleinfelder 2016).

2.2.2 Ecosystem Credits Required

The ecosystem credit species predicted to occur within the development site are listed in the credit calculator file 167/2016/3878MP. There were no ecosystem credit species excluded from the predicted species list or that had their offset multiplier modified for the assessment.

A total of 2,207 ecosystem credits are required for the development. **Table 9** outlines the biometric vegetation types requiring offsetting due to the proposed development and the number of ecosystem credits required to compensate for the proposed impacts at the development site. The biobanking credit report for the development site is included in **Appendix 4**.

Table 9: Summary of ecosystems credits generated at the development site

Vegetation Zone	Biometric Vegetation Type	Area of Zone	Current Site Value	Future Site Value	Credit Requirements
1	HU860: Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	19.05	57.81	0.00	895
2		18.48	82.29	0.00	1,207
3		2.84	44.27	0.00	105
Total Credit Requirements for HU860					**2,207**

2.2.3 Species Credits Required

The number of species credits required to compensate for the impacts of the proposed development is outlined in **Table 10**. The biobanking credit report for the development site is included in **Appendix 4**.

Table 10: Summary of species credits generated at the development site

Scientific Name	Common Name	Quantity of Loss	Species Credits
Eucalyptus camfieldii	Camfield's Stringybark	227 individuals	17,479
Eucalyptus parramattensis subsp. *decadens*	-	230 individuals	3,220
Pandion cristatus	Eastern Osprey	40.38 ha	525
Phascolarctos cinereus	Koala	40.38 ha	1,050
Crinia tinnula	Wallum Froglet	0.71 ha	9

STAGE 3: IMPROVING BIODIVERSITY VALUES

3.1 BIOBANK SITE

Refer to **Section 1.1.1.2** for details on the biobank site.

3.1.1 Ecosystem Credits Created

The ecosystem credit species predicted to occur within the development site are listed in the credit calculator file 167/2016/3878MP. There were no ecosystem credit species excluded from the predicted species list or that had their offset multiplier modified for the assessment.

A total of 859 ecosystem credits are created at the biobank site. **Table 11** outlines the biometric vegetation types within the biobank, the current site value, increased site value, averted loss and the number of ecosystem credits created within each vegetation zone. Note: the default increase in site value was applied to all vegetation zone, except Zone 8. The overstorey cover score for Zone 8 was increased from by 1.5 rather than 1, in accordance with Appendix 7 of the BBAM 2014. An outline the management actions that will be conducted to achieve this increase are outlined in **Section 3.1.3**.

The biobanking credit report for the development site is included in **Appendix 4**.

Table 11: Summary of ecosystems credits generated at the biobank site

Vegetation Zone	Biometric Vegetation Type	Area of Zone	Current Site Value	Increased Site Value	Averted Loss	Credits Created
1	HU917: Wallum Banksia-Monotoca scoparia heath on coastal sands of the Central Coast and lower North Coast	10.26	68.12	81.88	5.44	80
2	HU860: Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	25.65	66.67	84.90	5.86	231
3		3.60	56.25	70.31	4.04	27
4		1.73	44.79	63.54	3.52	15
5	HU851: Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands	29.91	69.27	93.75	5.08	311
6	HU865: Parramatta red gum - Fern-leaved banksia - Melaleuca sieberi swamp woodland of the Tomaree Peninsula	3.75	94.00	96.00	9.66	22

Vegetation Zone	Biometric Vegetation Type	Area of Zone	Current Site Value	Increased Site Value	Averted Loss	Credits Created
7	HU938: Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast	24.58	64.00	81.11	7.00	222
8		11.57	46.67	74.00	4.00	125
9		3.98	78.67	100.00	8.34	41
10	HU948: Wallum Bottlebrush - Leptocarpus tenax - Baloskion pallens Wallum sedge heath of the lower North Coast	15.10	73.91	85.51	6.88	115
					Total Credit Created	**1,189**

3.1.2 Species Credits Created

The number of species credits required to compensate for the impacts of the proposed development is outlined in **Table 10**. The biobanking credit report for the development site is included in **Appendix 4**.

Table 12: Summary of species credits generated at the biobank site

Scientific Name	Common Name	Quantity in Biobank	Species Credits
Eucalyptus camfieldii	Camfield's Stringybark	1,641	11,651
Eucalyptus parramattensis subsp. *decadens*	-	634 individuals	4,501
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	102	724
Pandion cristatus	Eastern Osprey	101.02	717
Phascolarctos cinereus	Koala	104.78	744
Crinia tinnula	Wallum Froglet	85.39	606

3.1.3 Management Actions

Retirement of biodiversity credits requires certain management actions to be implemented that underpin the predicted improvements to biodiversity values on the biobank site. These management actions are divided into two categories: standard management actions required for all biobank sites and additional management actions required for certain vegetation types and species. The specific actions proposed for each standard and additional management action category for the biobank site are set out in **Table 13** and **Table 14**, respectively. The additional actions are also listed in the biobanking credit report for the biobank site in **Appendix 4**. Specific details on the management actions to be undertaken at the biobank site would be provided as part of the biobanking agreement and will be detailed in the Management

Actions Template. The proposed location of fencing, signs and area of priority for weed control are shown on **Figure 13**.

Table 13: Standard management actions for biobank sites.

Standard management action category	Proposed actions
Management of grazing for conservation	• Installation and/or maintenance of stock exclusion fencing (wildlife friendly) along external property boundaries.
Weed control	• Preparation and implementation of a weed control action plan.
Management of fire for conservation	• Preparation and implementation of a fire management plan.
Management of human disturbance	• Installation and/or maintenance of fencing along boundaries to discourage encroachment of adjoining landholders and restrict recreational activities (e.g. trail bike riding, horse riding and hunting). • Restriction of vehicular access to the site by road. • Installation of signage at appropriate locations. • Liaison with adjoining landholders (where appropriate).
Retention of regrowth and remnant vegetation	• Installation and/or maintenance of fencing along certain boundaries. • Permitted clearing provisions of the NSW *Native Vegetation Act* are extinguished. • Firewood collection and timber harvesting are not permitted.
Replanting or supplementary planting where natural regeneration will not be sufficient	• Implementation of the planting actions.
Retention of dead timber	• Installation and/or maintenance of fencing or markers along boundaries. • Restriction of vehicular access to the site by road. • Installation of signage at appropriate locations.
Erosion control	• Repair existing tracks displaying active erosion. • Implementation of the erosion control actions.
Retention of rocks	• Installation and/or maintenance of fencing along land boundaries. • Restriction of vehicular access to the site by road. • Installation of signage at appropriate locations.
Note: These management actions are required to be considered under the BBAM; however, it is noted that not all are applicable to the site.	

Table 14: Additional management actions required for the biobank site.

Additional management action category	PCTs and species credit species to be targeted	Proposed actions
Control exotic pest fish species (within dams)	Wallum Froglet	No dams were identified within Wallum Froglet habitat: HU851, HU865, HU917, HU948, HU938.
Control of feral pigs	HU917, HU948	The implementation of the vertebrate pest management plan.
Exclude commercial apiaries	HU851, HU860, HU865, HU938	No establishment of commercial apiaries within the site.
Exclude miscellaneous feral species	HU851, HU860, HU865, HU938 Koala	The implementation of the vertebrate pest management plan.
Feral and/or overabundant native herbivore control	HU851, HU860, HU865, HU917, HU938, HU948 *E. parramattensis* subsp. *parramattensis*	No evidence of overabundant native herbivores (e.g. heavily grazed vegetation or large areas of bare ground) was observed during the assessment.
Fox control	HU851, HU860, HU865, HU917, HU938, HU948	The implementation of the vertebrate pest management plan.
Maintain or re-introduce natural flow regimes	Eastern Osprey, Wallum Froglet	No natural drainage lines identified within the site. A water management plan will be implemented to ensure run-off from the development site is managed.
Slashing	HU851, HU860, HU865, HU917, HU938, HU948 *E. parramattensis* subsp. *parramattensis,* Koala, Wallum Froglet	The exclusion of slashing would be achieved through installation and maintenance of boundary fencing.

3.1.3.1 Management Actions for Site Attribute Increase

Within Management Zone 8 of the biobank, the site attribute score for overstorey cover was increased by 1.5 rather than by 1 in accordance with Appendix 7 of the BBAM 2014. The current score for this site attribute within Zone 8 is 1, therefore the future site score of this attribute will be 2.5 rather than 2, if no additional management actions were undertaken.

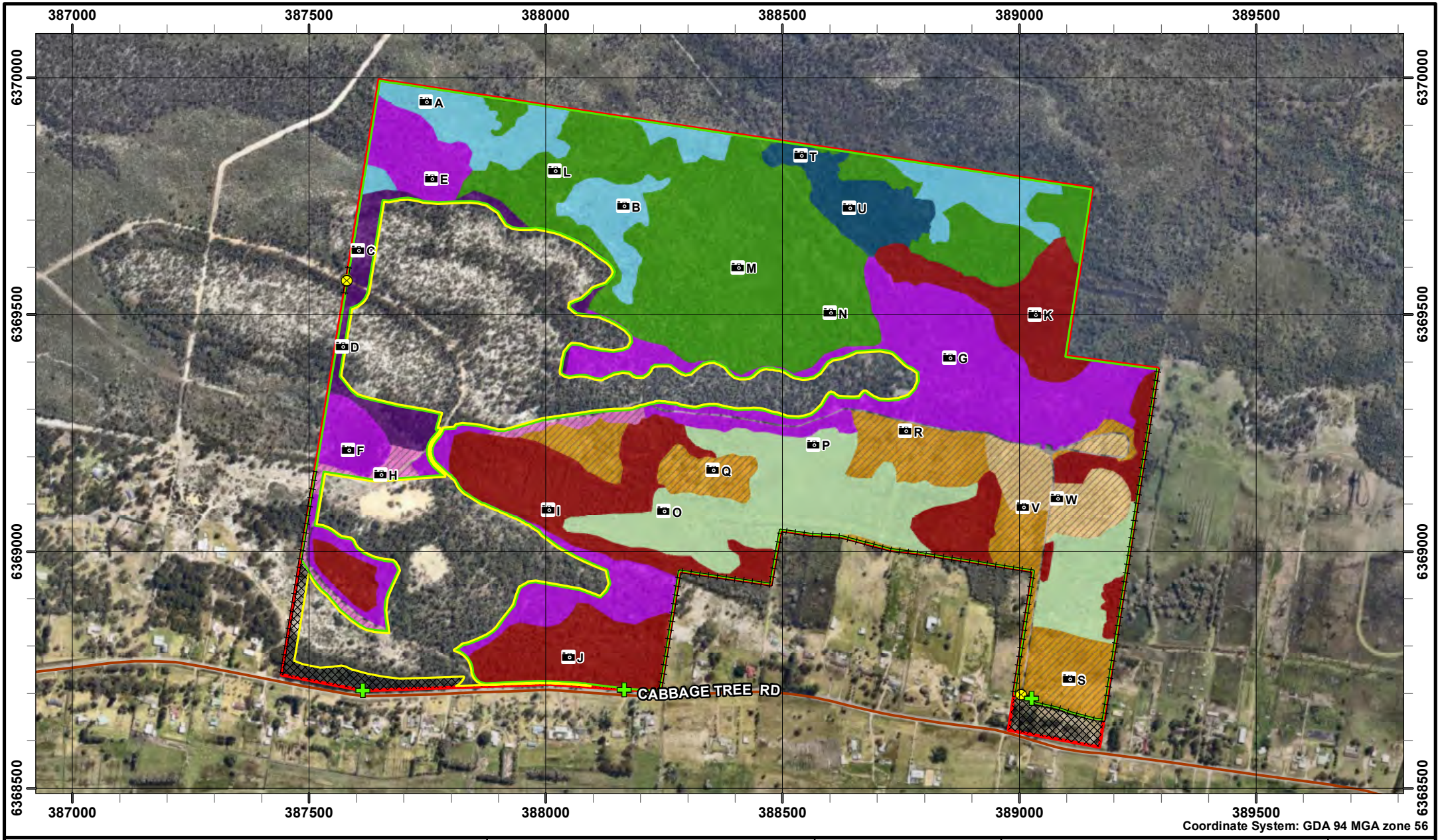
To increase the overstorey cover attribute score from 1 to 2.5, it must be document how additional management actions will achieve >50% - <75% or >100 - <125% of the percent native overstorey cover benchmark for the nominated PCT.

The overstorey benchmark for Zone 8 (HU938) is 15% - 70%. Currently the overstorey cover within the zone is an average of 4%. To allow for the increase in the site attribute, it is proposed to increase overstorey cover of the zone to approximately 53% (75% of the upper benchmark), which would represent an increase of 49% through additional planting within the zone. To achieve this target it is proposed to plant 1,347 overstorey species within Zone 8 (**Table 15**). Only tree species characteristic of this PCT will be used in the planting, these will include *Eucalyptus robusta* and *Melaleuca quinquenervia*.

If the Zone is 11,570 m^2, then an additional 54,115 m^2 of overstorey foliage cover will be need to be to achieve the target (increase by 49%). The calculation for the number of overstorey trees required to achieve the target is based on one mature overstorey species within a Swamp Forest having a foliage cover of 50 m^2, resulting in 1,122 plants required. An additional 20% was added to this planting number as a contingency.

Table 15: Planting strategy to achieve overstorey cover target

Target Cover	53%
Existing Cover Across Zone (Average Cover)	4%
Additional Cover Required to Achieve Target	49%
Area of Zone 8	11,570 m^2
Area of Overstorey Foliage Cover to Achieve Target	56,115 m^2
Cover of One Mature Canopy Tree in Swamp Forest	50 m^2
Number of Plants Required to Achieve Target	1,122
Number of Plants Required to Achieve Target + 20% Contingency	**1,347**



Legend

- Subject Land (176.1 ha)
- Biobank Site Boundary (131.1 ha)
- Development Site Boundary (42.3 ha)
- Excluded Areas (2.7 ha)
- Weed Infestation
- Arterial Road
- Fence (to be installed)
- Biobank Sign (to be installed)
- Gate (to be installed)
- Photo Location

Management Zone

1		6	
2		7	
3		8	
4		9	
5		10	

Metres
0 50 100 200 300 400 500
N

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PROJECT REFERENCE: 20170448
DATE DRAWN: 14/10/2016 09:13 Version 1
DRAWN BY: gjoyce
DATA SOURCE:
NSW Land and Property Information - 2011
nearmap - 2016

Management Actions & Photo Point Locations - Biobank Site

Williamtown Sand Syndicate
Offset Strategy
Proposed Sand Quarry
Cabbage Tree Road, Williamtown

FIGURE:
13

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STAGE 4: SUMMARY OF OFFSET STRATEGY

While the proposed development is not applying for a biobanking statement, the BBAM 2014 methodology has been used to determine the offset requirements of the proposal. It is proposed that the area of the subject site not proposed for be development be secured as a biobank site to, in part, fulfil the offsetting requirements of the development. Where additional credits are required, off-site offsets will be secured.

4.1 ECOSYSTEM CREDITS

The proposed development requires a total of 2,207 ecosystem credits for impacts on HU860. The development site credit report lists the following PCTs as offsetting options:

- HU860: Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast;
- HU832: Smooth-barked Apple - White Stringybark - Red Mahogany – Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast;
- HU851: Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands; and
- HU862: Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula.

The biobank site contains both HU860 and HU851. The area of these two vegetation communities within the study area created a total of 590 ecosystem credits, leaving a shortfall of 1,617 HU860 ecosystem credits. As no additional like-for-like ecosystem credits occur within the Subject Land it is proposed to apply the variation criteria for mitigated net loss (Tier 3) under the *NSW OEH Interim Policy on assessing and offsetting biodiversity impacts of Part 3A, State Significant Development (SDD) and State Significant Infrastructure (SII) Projects* (OEH 2011).

4.1.1 Variation Criteria

Under Tier 3: Negotiation a “Mitigated Net Loss Outcome” of the OEH Interim Policy (OEH 2011) there are six variation criteria. Kleinfelder proposes the use of variation criteria (f) – *Convert ecosystem credits to a regional conservation priority as identified in a regional conservation plan or similar*.

Variation criteria (f) is may be used when no matching credits are available and Variation 1 is not feasible. Variation 1 is not feasible as the proposed biobank does not contain any additional areas of PCTs within the same vegetation formation as HU860.

Variation criteria (f) is applied by:

- Identifying areas of high conservation priority in existing regional conservation plans or similar;
- Convert credits required to hectares; and
- Identify eligible offset sites and ensure areas are sufficient size, condition and landscape context.

These criteria are addressed in the following sections.

Areas of High Conservation Priority

The Lower Hunter Regional Conservation Plan (DECCW 2009) identifies the Watagan Ranges to Port Stephens corridor as a highly significant link in the region. While the proposed biobank is not specifically mapped as high priority conservation lands within this plan, it does occur within this regional link. Additionally, the biobank site has a number of landscape features which identify it as an area of high conservation value:

- The biobank site adjoins the Tilligerry State Conservation Area on its northern boundary and two adjoining Hunter water sites located to north and west are currently being investigated for potential biobank sites. The conservation of this land would extend this existing conservation reserve;
- The northern and southern sections of the biobank is mapped as key fauna habitat and is also located on the edge of a key fauna corridor (Richardson Road), mapped by Scott (2003);
- All land within the biobank site is currently zoned RU2 Rural Landscape under the Port Stephens LEP 2013. The dedication of this large area of land as an offset is likely to be strategically important for biodiversity conservation in a regional context given the sites location within a coastal region under increasing development pressure;
- Cleared areas (as a result of previous mining activities) within the develop site have the potential to be significantly improved through regeneration and rehabilitation all of which will improve biodiversity values on the site, increasing conservation gain;
- The biobank site supports large populations of threatened species (*E. camfieldii, E. parramattensis* subsp. *decadens*, *G. parviflora* subsp. *parviflora*, Eastern Osprey, Koala, Wallum Froglet, and an additional five ecosystem species were identified within the Subject Land), and an EEC (*Swamp Sclerophyll Forest*);
- Nest boxes would be installed within the rehabilitation area, further providing habitat for a range of hollow dependent fauna species; and

- A detailed rehabilitation plan has been prepared for the development ensuring these areas will be managed and returned to native vegetation.

Convert Credits Required to Hectares

The BBAM 2014 methodology will be used to determine the credits generated at the biobank site, with these credits being retired to partially fulfil the credit requirements at the development site.

Identify eligible offset sites

Kleinfelder propose that the biobank site is a sufficient offset to meet the ecosystem credit requirements of the proposal. Under the variation rule the offset must be of:

Sufficient size:

- The proposed biobank is of sufficient size to add to the conservation of biodiversity in the locality. The proposed site contains 130.14 ha of native vegetation, adding a large area of land to the southern boundary of the SCA;

Condition:

- All vegetation within the offset is of moderate to good condition. Management actions (as part of biobank site requirements) will be conducted across the site to ensure the condition of the vegetation and threatened species habitat is improved.

Landscape context:

- The biobank is directly adjacent to the development site, as such it occurs within the same IBRA sub-region (Karuah Manning) and Mitchell Landscape (Sydney – Newcastle Barriers and Beaches).

4.1.2 Ecosystem Credit Retirement

It is proposed to retire all ecosystem credits created at the biobank site (total 1,189 ecosystem credits), as per variation criteria (f) for mitigated net loss (tier 3) under the Interim Policy, to partially fulfil the ecosystem credit requirements at the development site.

It is recognised that the credits retired at the biobank site contribute to 54% of the total ecosystem credit required at the development site. As such, WSS are committed to retiring additional ecosystem credits.

4.1.2.1 Additional Ecosystem Credits Required

Williamtown Sand Syndicate are committed to retiring additional Koala species credits within the Tomago/ Tilligarry area (see **Section 4.2**). Currently, WSS are investigating four properties

located to the east of Williamtown Airport to establish a biobank in order to achieve the required Koala species credits. If a proportion of these properties can be established as a biobank then additional ecosystem credits will be available for retirement.

A desktop assessment of these allotments has identified that the dominant vegetation communities are Swamp Mahogany – Paperbark Swamp Forest and Heath with some areas of Coastal Sand Apple – Blackbutt Forest and Tomago Sand Swamp Woodland (NPWS 2000). While these vegetation communities do not fulfil the like-for-like requirement, these allotments would provide a suitable biodiversity offset as they are an area of high conservation value:

- The allotments either directly adjoin the Tilligarry SCA or Hunter Water land that is adjoining the SCA;
- The allotments are mapped as key fauna habitat and are also located within a key fauna corridor (Williamtown), mapped by Scott (2003);
- There are a number of Atlas records of *Eucalyptus parramattensis* subsp. *decadens* and Koala within and directly adjacent to the allotments; and
- The vegetation within the sites is remnant vegetation in moderate to good condition;

It is unlikely that all identified properties will be able to be secured for a biobank, as such, if two of the allotments can be secured it would provide an additional 75 – 100 ha of vegetated land. Based on an average of 8 credits/ ha generated at the on-site biobank within similar vegetation communities (ranged between 5.8 - 9 credits/ ha), the proposed offsite biobank could generate between 600 and 800 ecosystem credits. If this additional off-site biobank can be secured, it has the potential to bring the total ecosystem credits to 81% - 90% of the required credits at the development site.

Willimatown Sand Syndicate are committed to retiring between 80% - 85% of the required ecosystem credits for the development, utilising the ecosystem credits generated at the on-site biobank and additional credits available at a potential off-site biobank. The retirement of this proportion of ecosystem credits is adequate for the proposed development, given that the impact area predominantly contains rehabilitated or regenerating vegetation (54% of the impact area), and the majority of the vegetation within the on-site and potential off-site biobanks is old-growth forest. Additionally, both the on-site and potential offsite biobanks contain a threatened ecological community (*Swamp Sclerophyll Forest*) and multiple threatened species (or historical records).

If the ecosystem credits generated at the proposed off-site biobank fall short the 80 – 85% target, additional credits will be sought. These credits will either be purchased from the register or generated at an additional off-site offset.

4.2 SPECIES CREDITS

The biobank site fulfils the species credit requirements for impacts on *Eucalyptus parramattensis* subsp. *decadens*, Eastern Osprey and Wallum Froglet. The biobank site does not generate enough species credits for *Eucalyptus camfieldii,* with a shortfall of 5,828 species credits, and the Koala, with a shortfall of 306 species credits.

4.2.1 *Eucalyptus camfieldii* Species Credits

The biobank fulfils 67% of the species credits required for *Eucalyptus camfieldii* at the development site. As such it is proposed to apply Variation Criteria (B) – *Convert one type of species credit to another type of species credit with the same or more endangered conservation status,* under Tier 3: Negotiation a "Mitigated Net Loss Outcome" of the OEH Interim Policy (OEH 2011).

Eucalyptus camfieldii is listed as Vulnerable under the TSC Act, as such the residual species credits generated at the Biobank site for *E. parramattensis* subsp. *decadens,* listed as Vulnerable (1,281) and *G. parviflora* subsp. *parviflora*, listed as Vulnerable (724), can be used to offset impacts to *E. camfieldii* under this variation criteria. As such to total number of species credits available at the biobank to offset impact on *E. camfieldii* at the development site is 13,656 (78% of the required 17,479 credits).

The fulfilment of 78% of the *E. camfieldii* ecosystem credits is considered adequate. As the majority of the *E. camfieldii* within the development site is part of a planted (rehabilitated) population. It is highly unlikely that the species would have present in this area prior to rehabilitation. The majority of the naturally occurring population within the biobank was identified a lower elevations, typically below 6 m elevation, within the Coastal Sand Wallum Woodland-Heath and Tomago Sand Swamp Heath. Only a few individuals were identified within the Coastal Sand Apple Blackbutt Forest, these individuals occur at elevations below 9 m in areas which are co-dominated by *Eucalyptus piperita* (Sydney Peppermint) and with *Melaleuca nodosa* (Prickly-leaved Paperbark) in the understorey. Additionally, the species will be replanted within the rehabilitation area, as it will represent potential habitat for the species due to the lower elevation of the final landform.

Furthermore, there are additional species credits generated at the biobank for both the Eastern Osprey and Wallum Froglet. While these fauna species credits may not directly transfer to offset impacts against *E. camfieldii*, WSS propose to retire these credits as part of the offset package for the development.

4.2.2 Koala Species Credits

OEH (in correspondence DOC15/491264-2) have indicated that offsets for impacts on Koala habitat for the proposed development are to target known occupancy within the Tomago/Tilligerry area. OEH also stipulates that it must be determined by the proponent as to whether there is an appropriate quantum of land and/or biodiversity credits available which can be managed and conserved under an OEH endorsed mechanism.

To compensate for the shortfall of 306 Koala species credits the proponent commits to securing all remaining Koala credits for the proposed development prior to the commencement of the development. Preferred and/or supplementary Koala habitat within the Tomago Sandbeds Koala Management Unit (KMU) will be targeted for offsetting.

An analysis of the available suitable land was conducted to determine whether there is an appropriate amount of land within the Tomago Sandbeds KMU available. The analysis involved examining available vegetation mapping for the Tomago Sandbeds KMU and assigning each vegetation community type as preferred, supplementary or other Koala habitat based on comparison of the floristic descriptions of the vegetation mapping studies with the descriptions of preferred and supplementary habitat by Lunney *et al*. (1998) and PSC (2002). The desktop analysis was primarily based on the *Vegetation of the Tomago and Anna Bay Sandbeds* (Bell and Driscoll 2006), which covers most of the Tomago Sandbeds KMU and is the most accurate and recent vegetation mapping available. For areas not covered by the Bell and Driscoll (2006) mapping within the Tomago Sandbeds KMU, the *Lower Hunter and Central Coast Regional Environment Management Strategy* (LHCCREMS; NPWS, 2000) vegetation mapping was used.

An estimation of the amount of preferred and supplementary Koala habitat available is detailed in **Table 16**. Based on the current version of the biobanking calculator, the Koala species credits that could be generated from the estimated area of preferred and supplementary habitat on freehold land within the Tomago KMU is 13,277 species credits. This well exceeds the remaining Koala species credits required for the proposed development, 306 species credits. It is noted that the analysis output in **Table 16** excludes all areas of mapped Koala habitat within areas that have been developed since the mapping was undertaken, and small lots which would not be feasible/desirable to purchase. The total area of Koala habitat on freehold land also includes all Hunter Water owned land.

As such, it has been determined that there is sufficient Koala habitat present on freehold land in the Tomago Sandbeds KMU. Previous correspondence within Hunter Water provides greater certainty that Koala species credits could become available through the establishment of biobank site(s) on Hunter Water owned land within the Tomago Sandbeds KMU which have the potential to be secured under a biobanking agreement.

Table 16: Estimated preferred and supplementary Koala habitat and potential Koala species credits that could be generated within the Tomago Sandbeds KMU

Koala habitat category	Equivalent vegetation map units (MU)		Total area (ha) of Koala habitat on freehold land	Number of potential Koala species credits on freehold land
	Bell and Driscoll (2006)	LHCCREMS (2000)		
Preferred	5, 7, 9, 17-19, 21, 24 & 43	36 & 37	968 ha	6,873
Supplementary	1-3, 11, 22 and 41	33	902 ha	6,404
Marginal, other and excluded	20, 23, 25-29, 31-38 & 42	9, 12, 15, 17, 30, 34, 36a, 40, 44, 46 and 47	N/A	N/A
		Total	**1,870 ha**	**13,277**

The timeframe of when these credits on Hunter Water land will become available is not clear. As such, WSS are also investigating potential freehold land in the vicinity on which to establish a potential biobank. As discussed above, there is the potential to secure a biobank with approximately 75 – 100 ha of native vegetation on land located to the east of the Williamtown Airport within the Tomago Sandbeds KMU. Of this vegetation 40 – 60 ha could be classified as preferred or supplementary Koala habitat. Based on the credits per hectare generated at the on-site biobank (7.1 credits per ha), the potential off-site biobank could create between 284 – 426 Koala species credits. As such, if appropriate allotments can be secured under a biobank, there is the potential for this off-site biobank to fulfil the remaining 306 Koala credits required.

Williamtown Sand Syndicate are committed to retiring the remaining 306 Koala species credits at an off-site offset within the Tomago Sandbeds KMU prior to the commencement of the development.

4.2.3 Species Credit Retirement

It is proposed to retire all species credits generated at the biobank site to fulfil, or partially fulfil, the requirements at the development site (**Table 17**).

Table 17: Species Credit Retirement

Species	Credits Retired (credits required at Development Site)
Eucalyptus camfieldii	11,651 *Eucalyptus camfieldii* 1,281 *Eucalyptus parramattensis* subsp. *decadens* 724 *Grevillea parviflora* subsp. *parviflora* **Total 13,656 credits retired (78% - 17,479 credits required)**
Eucalyptus parramattensis subsp. *decadens*	3,220 *Eucalyptus parramattensis* subsp. *decadens* credits retired (100% of credits required)
Eastern Osprey	717 Eastern Osprey (137% of credits required).
Koala	744 Koala (71% of required)
Wallum Froglet	606 Wallum Froglet (6,733% of credits required)

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APPENDIX 1. COUNCIL APPROVAL

APPENDIX 2. PLOT DATA

Development Site

Quadrat Number			Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q9		Q10		Q11	
Vegetation Code			HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860	
Condition/ Zone			Rehab		Rehab		Rehab		Rehab		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Regen		Regen		Regen	
Easting			387752		387934		387690		387757		387794		387865		388083		388519		387583		387524		387669	
Northing			6369721		6369600		6369573		6369331		6369063		6368989		6369350		6369331		6369129		6368867		6368793	
Family	Scientific Name	Common Name	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Anthericaceae	*Tricoryne simplex*																		1	10			1	10
Apiaceae	*Platysace ericoides*		1	20							1	20	1	10	1	25	1	10	5	100	1	15	1	5
Apocynaceae	*Marsdenia suaveolens*	Scented Marsdenia											1	3			1	2						
Asteraceae	**Senecio madagascariensis*	Fireweed																			1	3		
Asteraceae	*Actinotus helianthi*	Flannel Flower	80	1000	50	1000	30	400	20	500	1	5			30	270	30	300	1	5	5	70	1	5
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	Wonga Wonga Vine	1	10							1	20	1	20	1	2								
Casuarinaceae	*Allocasuarina littoralis*	Black she-oak											1	2										
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak									1	10												
Cyperaceae	*Ptilothrix deusta*														1	8								
Cyperaceae	*Schoenus ericetorum*	Heath Bog-rush	1	20	1	100													1	100				
Dennstaedtiaceae	*Pteridium esculentum*	Common Bracken	20	100							20	1000	2	50	1	10	25	100	1	2	3	30	3	40
Dilleniaceae	*Hibbertia fasciculata*														1	3					1	5		
Dilleniaceae	*Hibbertia linearis*		1	20	1	10	1	40	1	20	1	20	1	20	1	4	1	20	3	50	1	15	1	5
Ericaceae - Epacridoideae	*Astroloma pinifolium*	Pine Heath	1	5			1	50	1	20					1	10			1	20	1	45	1	30
Ericaceae - Epacridoideae	*Brachyloma daphnoides*	Daphne Heath							2	60									1	10				
Ericaceae - Epacridoideae	*Leucopogon appressus*				1	1													1	10				
Ericaceae - Epacridoideae	*Leucopogon ericoides*	Pink Beard-heath			1	500	2	50	1	1	1	50							3	500				
Ericaceae - Epacridoideae	*Leucopogon esquamatus*																1	10						
Ericaceae - Epacridoideae	*Leucopogon juniperinus*	Prickly Beard-heath															2	15						
Ericaceae - Epacridoideae	*Leucopogon lanceolatus* var. *lanceolatus*																1	10						
Ericaceae - Epacridoideae	*Leucopogon virgatus*						1	2																
Ericaceae - Epacridoideae	*Monotoca elliptica*	Tree Broom-heath	1	50			2	50	3	100	1	50	1	50	1	65			1	20	1	160	4	60
Ericaceae - Epacridoideae	*Monotoca scoparia*				2	20	1	2	1	5									1	20	1	25		
Ericaceae - Epacridoideae	*Woollsia pungens*		1	10	1	1000	2	400	2	50					1	35								
Euphorbiaceae	*Amperea xiphoclada* var. *xiphoclada*														1	15								
Euphorbiaceae	*Poranthera microphylla*		1	10																				
Euphorbiaceae	*Ricinocarpos pinifolius*	Wedding Bush	1	5	1	20	1	10			1	5	1	5	1	10	1	5	3	50	1	20	1	20
Fabaceae - Faboideae	*Aotus ericoides*		3	20	2	20	1	2	1	2					1	5	1	3						
Fabaceae - Faboideae	*Bossiaea heterophylla*	Variable Bossiaea	1	20	10	500	10	100	10	200	1	50			4	120	1	10					1	1
Fabaceae - Faboideae	*Bossiaea obcordata*	Spiny Bossiaea							15	260									3	40				
Fabaceae - Faboideae	*Bossiaea rhombifolia*																				1	10	1	10
Fabaceae - Faboideae	*Dillwynia floribunda*										1	1							1	30				
Fabaceae - Faboideae	*Dillwynia glaberrima*																				1	10		
Fabaceae - Faboideae	*Dillwynia retorta*		5	100	3	50	30	100	10	200					10	100	1	15						
Fabaceae - Faboideae	*Gompholobium glabratum*	Dainty Wedge Pea									1	5												
Fabaceae - Faboideae	*Gompholobium latifolium*	Golden Glory Pea			1	1			1	30	1	5			1	3								
Fabaceae - Faboideae	*Hardenbergia violacea*	Purple Coral Pea							1	10	1	10	3	500							1	4	1	4
Fabaceae - Mimosoideae	*Acacia brownii*	Prickly Moses			1	1					1	10												
Fabaceae - Mimosoideae	*Acacia longifolia* subsp. *longifolia*	Sydney Golden Wattle							1	10	2	10	1	20	1	5			1	4	3	30	5	80
Fabaceae - Mimosoideae	*Acacia suaveolens*	Sweet Wattle	1	1	1	3	2	5	3	40					1	10					1	5	1	1
Fabaceae - Mimosoideae	*Acacia terminalis var. Long inflorescences (P.G.Kodela 307)*	Sunshine Wattle					5	10	4	40	20	50	1	10										
Fabaceae - Mimosoideae	*Acacia ulicifolia*	Prickly Moses	2	10			5	10	25	200			3	50	3	60	1	5	2	20	1	25	3	40
Haemodoraceae	*Haemodorum planifolium*																		1	30				
Haloragaceae	*Gonocarpus teucrioides*	Raspwort									1	10	1	20									1	2
Lauraceae	*Cassytha glabella*		1	1					1	3					1	15								
Lomandraceae	*Lomandra cylindrica*	Needle Mat- rush	1	1																				
Lomandraceae	*Lomandra glauca*	Pale Mat-rush			1	50	2	100			1	100	1	50	2	40	1	10	1	20			1	5
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush					1	1	1	5	1	5	1	50	1	1			1	2	1	5		
Myrtaceae	# *Eucalyptus camfieldii*	Camfield's Stringybark			1	1																		
Myrtaceae	# *Eucalyptus parramattensis* subsp. *decadens*				3	3	5	4																
Myrtaceae	*Angophora costata*	Smooth-barked Apple	5	3	5	2	1	1	1	2	40	20	40	9					1	2	20	9	1	2
Myrtaceae	*Callistemon rigidus*	Stiff Bottlebrush					1	1																
Myrtaceae	*Corymbia gummifera*	Red Bloodwood	10	4	3	2	2	1	3	4	20	8	10	3	40	18	5	3						
Myrtaceae	*Eucalyptus pilularis*	Blackbutt							10	9														
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint					5	3									40	14						
Myrtaceae	*Eucalyptus signata*	Scribbly Gum	30	2	10	2	5	2	5	3														
Myrtaceae	*Leptospermum laevigatum*	Coast Teatree																	15	280	10	120	2	30
Myrtaceae	*Leptospermum polygalifolium* subsp. *cismontanum*	Tantoon	1	10																				

Development Site

Quadrat Number			Q1		Q2		Q3		Q4		Q5		Q6		Q7		Q8		Q9		Q10		Q11	
Vegetation Code			HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860	
Condition/ Zone			Rehab		Rehab		Rehab		Rehab		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Regen		Regen		Regen	
Easting			387752		387934		387690		387757		387794		387865		388083		388519		387583		387524		387669	
Northing			6369721		6369600		6369573		6369331		6369063		6368989		6369350		6369331		6369129		6368867		6368793	
Family	**Scientific Name**	**Common Name**	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Myrtaceae	*Leptospermum trinervium*	Flaky-barked Tea-tree	20	20	30	50	3	5			1	5			2	35	1	10			1	10		
Myrtaceae	*Melaleuca sieberi*																				1	1		
Myrtaceae	*Melaleuca thymifolia*	Thyme Honey- myrtle																			1	1		
Orchidaceae	*Acianthus fornicatus*	Pixie Caps	1	100							1	100	1	500			1	20						
Orchidaceae	*Pterostylis longifolia*	Tall Greenhood	1	100					1	10														
Phormiaceae	*Dianella caerulea*	Blue Flax-lily	1	20	1	10	2	100			4	100	3	500	1	4	1	10	5	50	3	30	3	30
Phyllanthaceae	*Breynia oblongifolia*	Coffee Bush																			1	25	2	30
Poaceae	**Eragrostis curvula*	African Love Grass																	50	200	15	80	65	300
Poaceae	**Melinis repens*	Red Natal Grass																	20	500	30	200	20	100
Poaceae	*Cynodon dactylon*	Couch																					1	3
Poaceae	*Eragrostis brownii*	Brown's Lovegrass					1	1	1	10									1	10	1	15	1	20
Poaceae	*Imperata cylindrica*	Blady Grass																			1	5		
Poaceae	*Themeda triandra*	Kangaroo Grass																					1	10
Polygalaceae	*Comesperma ericinum*	Pyramid Flower			1	10	2	10																
Proteaceae	*Banksia aemula*	Wallum Banksia			1	1																		
Proteaceae	*Banksia integrifolia*	Coast Banksia					1	4	1	5													1	3
Proteaceae	*Banksia serrata*	Old Man Banksia	5	5			3	2			2	40	1	20	10	30	20	80			2	15	5	120
Proteaceae	*Conospermum taxifolium*	Variable Smoke-bush					5	50									1	10	5	60			1	3
Proteaceae	*Isopogon anemonifolius*	Broad- leaf Drumsticks					1	2																
Proteaceae	*Persoonia lanceolata*	Lance Leaf Geebung	1	10			10	100	1	20			1	2	1	20	1	20	1	100	2	80	5	120
Proteaceae	*Persoonia levis*	Broad-leaved Geebung			2	50					1	10							2	5	1	20		
Pteridaceae	*Cheilanthes sieberi*																				1	5	1	10
Rubiaceae	*Pomax umbellata*		1	50			1	20	1	20	2	500	5	1000					1	10	2	30	1	10
Rutaceae	*Eriostemon australasius*	Pink Wax Flower	2	10	2	10	1	1							5	50	5	45						
Thymelaeaceae	*Pimelea linifolia subsp. linifolia*	Slender Rice-flower	1	15							1	100	3	100	1	25					1	25	1	1
Verbenaceae	**Lantana camara*	Lantana																	1	1	2	3	2	2
Xanthorrhoeaceae	*Xanthorrhoea latifolia*												1	1										
Zamiaceae	*Macrozamia communis*	Burrawang									4	10	30	100					1	2	1	4	1	2
		Total Species Richness	**31**		**26**		**34**		**29**		**30**		**25**		**29**		**23**		**32**		**36**		**34**	

* Denotes Introducted Species

# Denotes Threatened Species (Listed under TSC Act and/ or EPBC)

Offset Site

Quadrat Number			Q12		Q13		Q14		Q15		Q16		Q17		Q18		Q19		Q20		Q21		Q22		Q23		Q24		Q25		Q26	
Vegetation Code			HU917		HU917		HU917		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU851		HU851		HU851	
Condition/ Zone			Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Rehab		Rehab		Rehab		Regen		Mod-Good		Mod-Good		Mod-Good	
Easting			387747		388164		388931		387759		387583		388853		389029		389209		387603		387569		387696		387650		388019		388302		388406	
Northing			6369950		6369730		6369769		6369788		6369215		6369410		6369288		6369358		6369638		6369434		6369249		6369163		6369804		6369727		6369600	
Family	Scientific Name	Common Name	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	s	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Anthericaceae	*Tricoryne simplex*																						1	10	1	1						
Apiaceae	*Centella asiatica*	Indian Pennywort																														
Apiaceae	*Platysace ericoides*		2	100	1	10	1	1	1	10					1	4			1	5	1	50	2	20	5	1000	1	100	1	10	2	45
Apiaceae	*Trachymene incisa*		1	10			2	100																								
Apocynaceae	*Gomphocarpus fruticosus*	Narrow- leaved Cottonbush																														
Apocynaceae	*Marsdenia suaveolens*	Scented Marsdenia													1	10																
Apocynaceae	*Parsonsia straminea*	Common Silkpod									2	1																				
Asteraceae	**Bidens pilosa*	Cobblers Pegs																														
Asteraceae	**Conyza bonariensis*	Flaxleaf Fleabane																														
Asteraceae	**Hypochaeris radicata*	Catsear																														
Asteraceae	**Senecio madagascariensis*	Fireweed																					1	1								
Asteraceae	*Actinotus helianthi*	Flannel Flower									1	10							10	500	15	500	10	200	1	50					1	15
Asteraceae	*Ozothamnus diosmifolius*	Rice Flower																														
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	Wonga Wonga Vine							2	10	1	10			2	50	1	1					1	10	1	2	1	5				
Blandfordiaceae	*Blandfordia nobilis*	Christmas Bells					1	1																								
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern																														
Blechnaceae	*Blechnum indicum*	Swamp Water Fern															5	25														
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak									1	1																				
Casuarinaceae	*Casuarina glauca*	Swamp Oak																	1	10												
Commelinaceae	*Commelina cyanea*														1	2																
Cyperaceae	**Isolepis prolifera*																															
Cyperaceae	*Baumea articulata*	Jointed Twig-rush																														
Cyperaceae	*Baumea rubiginosa*																															
Cyperaceae	*Baumea sp.*																															
Cyperaceae	*Baumea teretifolia*																															
Cyperaceae	*Caustis pentandra*																										1	1				
Cyperaceae	*Caustis recurvata*				1	20	1	10																					1	1	1	20
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge															20	45														
Cyperaceae	*Gahnia sieberiana*	Red-fruit Saw-sedge																														
Cyperaceae	*Lepidosperma laterale*																										2	50				
Cyperaceae	*Ptilothrix deusta*		1	20					1	100							1	4													1	10
Cyperaceae	*Schoenus brevifolius*	Zig- zag Bog- rush	1	50																					1	100					1	2
Cyperaceae	*Schoenus ericetorum*	Heath Bog-rush	1	100	1	10			2	100									1	10	1	20					2	500	2	50	1	5
Dennstaedtiaceae	*Histiopteris incisa*	Bat's Wing Fern																														
Dennstaedtiaceae	*Pteridium esculentum*	Common Bracken							50	500	100	1000	40	100	5	100	20	100	1	5					10	100						
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern																														
Dilleniaceae	*Hibbertia acicularis*				1	10																							1	1		
Dilleniaceae	*Hibbertia fasciculata*		1	50	1	50	1	5																					1	50	1	4
Dilleniaceae	*Hibbertia linearis*								1	10	1	10	1	5	1	5			1	10	1	10	2	20	1	50	1	1				
Droseraceae	*Drosera auriculata*																															
Droseraceae	*Drosera binata*	Forked Sundew															1	5														
Droseraceae	*Drosera peltata*																															
Elaeocarpaceae	*Tetratheca thymifolia*	Thyme Pink-bells															1	3									1	1				
Ericaceae - Epacridoideae	*Astroloma pinifolium*	Pine Heath	1	1	1	10													1	20	1	20	1	30	1	20	1	1	1	1	1	15
Ericaceae - Epacridoideae	*Brachyloma daphnoides*	Daphne Heath			1	2													1	5	1	3			1	1						
Ericaceae - Epacridoideae	*Epacris obtusifolia*	Blunt- leaf Heath																														
Ericaceae - Epacridoideae	*Epacris pulchella*	Wallum Heath																														
Ericaceae - Epacridoideae	*Leucopogon appressus*																														1	25
Ericaceae - Epacridoideae	*Leucopogon ericoides*	Pink Beard-heath	1	50	2	100	1	100	2	100									2	50	10	250	1	5	2	100	1	50	2	1000	1	20
Ericaceae - Epacridoideae	*Leucopogon esquamatus*						1	1	4	10																						
Ericaceae - Epacridoideae	*Leucopogon juniperinus*	Prickly Beard-heath																													1	30
Ericaceae - Epacridoideae	*Leucopogon lanceolatus* var. *lanceolatus*										1	2	1	1	1	10	1	30														
Ericaceae - Epacridoideae	*Leucopogon leptospermoides*																															
Ericaceae - Epacridoideae	*Leucopogon virgatus*				1	5													2	10			1	10					1	1		
Ericaceae - Epacridoideae	*Monotoca elliptica*	Tree Broom-heath					1	50	1	100	1	20			1	40	1	25					2	30	1	100	1	1	3	50		
Ericaceae - Epacridoideae	*Monotoca scoparia*		1	20	1	10	2	50											30	50							1	20			2	40

Offset Site

Quadrat Number			Q12		Q13		Q14		Q15		Q16		Q17		Q18		Q19		Q20		Q21		Q22		Q23		Q24		Q25		Q26	
Vegetation Code			HU917		HU917		HU917		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU851		HU851		HU851	
Condition/ Zone			Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Rehab		Rehab		Rehab		Regen		Mod-Good		Mod-Good		Mod-Good	
Easting			387747		388164		388931		387759		387583		388853		389029		389209		387603		387569		387696		387650		388019		388302		388406	
Northing			6369950		6369730		6369769		6369788		6369215		6369410		6369288		6369358		6369638		6369434		6369249		6369163		6369804		6369727		6369600	
Family	Scientific Name	Common Name	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	s	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Ericaceae - Epacridoideae	*Styphelia viridis*	Green Five-corners																			1	50										
Ericaceae - Epacridoideae	*Woollsia pungens*																				1	30										
Euphorbiaceae	*Amperea xiphoclada* var. *xiphoclada*		1	10	3	500	1	10	4	100									1	5							1	10	1	50	1	20
Euphorbiaceae	*Homalanthus populifolius*	Bleeding Heart																														
Euphorbiaceae	*Ricinocarpos pinifolius*	Wedding Bush			1	20	1	5	2	10									1	10	1	2	2	30	1	2	1	10	5	10	1	20
Fabaceae - Faboideae	*Almaleea paludosa*																															
Fabaceae - Faboideae	*Aotus ericoides*				2	50			2	40							2	30	1	5	1	3	1	10			1	5				
Fabaceae - Faboideae	*Bossiaea ensata*	Sword Bossiaea			1	20															1	10										
Fabaceae - Faboideae	*Bossiaea heterophylla*	Variable Bossiaea	2	50	1	50	5	100	5	100			1	10					1	20	3	100	2	30	1	10	5	50	10	50	5	80
Fabaceae - Faboideae	*Bossiaea obcordata*	Spiny Bossiaea																					5	60								
Fabaceae - Faboideae	*Bossiaea rhombifolia*										1	10									2	30										
Fabaceae - Faboideae	*Daviesia ulicifolia*	Gorse Bitter Pea																							3	20						
Fabaceae - Faboideae	*Dillwynia floribunda*																						1	1								
Fabaceae - Faboideae	*Dillwynia retorta*				1	50			5	100	1	1							10	500	10	100	5	50	1	10	2	100	1	10	15	60
Fabaceae - Faboideae	*Glycine microphylla*	Small- leaf Glycine															1	1														
Fabaceae - Faboideae	*Glycine tabacina*														1	1																
Fabaceae - Faboideae	*Gompholobium latifolium*	Golden Glory Pea																					1	10								
Fabaceae - Faboideae	*Gompholobium virgatum*	Leafy Wedge Pea			1	2																										
Fabaceae - Faboideae	*Hardenbergia violacea*	Purple Coral Pea									1	1	2	20	1	4					1	10	1	3			1	1				
Fabaceae - Faboideae	*Indigofera australis*	Australian Indigo													1	3																
Fabaceae - Faboideae	*Kennedia rubicunda*	Dusky Coral Pea													1	15	1	20														
Fabaceae - Faboideae	*Mirbelia rubiifolia*	Heathy Mirbelia																														
Fabaceae - Faboideae	*Pultenaea retusa*	Notched Bush- pea															1	25														
Fabaceae - Faboideae	*Viminaria juncea*	Golden Spray																														
Fabaceae - Mimosoideae	**Acacia saligna*	Golden Wreath Wattle																														
Fabaceae - Mimosoideae	*Acacia brownii*	Prickly Moses	1	5			2	10	2	10																						
Fabaceae - Mimosoideae	*Acacia elongata*	Swamp Wattle																														
Fabaceae - Mimosoideae	*Acacia floribunda*	White Sally Wattle													60	300																
Fabaceae - Mimosoideae	*Acacia longifolia* subsp. *longifolia*	Sydney Golden Wattle									1	3	10	50	1	20	3	50			1	5	1	20	2	50						
Fabaceae - Mimosoideae	*Acacia stricta*	Straight Wattle																														
Fabaceae - Mimosoideae	*Acacia suaveolens*	Sweet Wattle					1	1	20	20					1	10			1	5	20	250	2	10			1	5			1	5
Fabaceae - Mimosoideae	*Acacia terminalis var. Long inflorescences (P.G.Kodela 307)*	Sunshine Wattle									20	40									5	50	5	15	1	20						
Fabaceae - Mimosoideae	*Acacia ulicifolia*	Prickly Moses									1	2	1	20	1	5	1	2	1	10	25	250	10	70	1	5					1	10
Gleicheniaceae	*Gleichenia dicarpa*	Pouched Coral Fern																														
Goodeniaceae	*Dampiera stricta*						1	100																					2	50	3	80
Goodeniaceae	*Goodenia bellidifolia*																															
Haemodoraceae	*Haemodorum planifolium*				1	5																					4	500	1	10	2	45
Haloragaceae	*Gonocarpus micranthus subsp. micranthus*																1	10														
Haloragaceae	*Gonocarpus teucrioides*	Raspwort									1	20	1	5	1	8	1	10					1	3	1	1						
Hydrocharitaceae	*Ottelia ovalifolia*	Swamp Lily																														
Iridaceae	*Patersonia sericea*	Silky Purple-flag									1	5																				
Juncaceae	*Juncus continuus*																															
Juncaceae	*Juncus usitatus*																															
Lauraceae	*Cassytha glabella*																														1	10
Lauraceae	*Cassytha pubescens*																		1	1												
Loganiaceae	*Mitrasacme polymorpha*																						1	5								
Lomandraceae	*Lomandra confertifolia*	Mat- rush							1	1																						
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Wattle Mat-rush									1	5																				
Lomandraceae	*Lomandra glauca*	Pale Mat-rush			1	5	1	10	2	100	1	10			1	10					1	20			2	100	4	500	1	50	1	20
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush					1	10			2	10	1	10	5	60			1	1	1	5					1	10				
Lomandraceae	*Lomandra micrantha*	Small- flower Mat- rush													1	4																
Malvaceae	**Sida rhombifolia*	Paddy's Lucerne																														
Menyanthaceae	*Liparophyllum exaltatum*																															
Myrtaceae	*[#] Eucalyptus camfieldii*	Camfield's Stringybark																	5	1											5	11
Myrtaceae	*Angophora costata*	Smooth-barked Apple							2	1	40	15	40	4	30	30	45	40	1	1	5	3	10	4	1	1						
Myrtaceae	*Callistemon citrinus*	Crimson Bottlebrush															1	20														

Offset Site

Quadrat Number			Q12		Q13		Q14		Q15		Q16		Q17		Q18		Q19		Q20		Q21		Q22		Q23		Q24		Q25		Q26	
Vegetation Code			HU917		HU917		HU917		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU851		HU851		HU851	
Condition/ Zone			Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Rehab		Rehab		Rehab		Regen		Mod-Good		Mod-Good		Mod-Good	
Easting			387747		388164		388931		387759		387583		388853		389029		389209		387603		387569		387696		387650		388019		388302		388406	
Northing			6369950		6369730		6369769		6369788		6369215		6369410		6369288		6369358		6369638		6369434		6369249		6369163		6369804		6369727		6369600	
Family	Scientific Name	Common Name	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	s	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Myrtaceae	*Callistemon pachyphyllus*	Wallum Bottlebrush																	1	1												
Myrtaceae	*Callistemon sp.*																															
Myrtaceae	*Corymbia gummifera*	Red Bloodwood	1	1					50	13	5	1			10	3	5	2	1	1	10	3	10	3			2	1				
Myrtaceae	*Eucalyptus globoidea*	White Stringybark																														
Myrtaceae	# *Eucalyptus parramattensis* subsp. *decadens*																		1	2	1	1										
Myrtaceae	*Eucalyptus pilularis*	Blackbutt							4	1									2	1	25	4	40	6								
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint	1	1																	20	5							20	4		
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany															5	1														
Myrtaceae	*Eucalyptus signata*	Scribbly Gum							2	1			20	3					5	2	10	2	5	1			30	4			10	2
Myrtaceae	*Euryomyrtus ramosissima*	Rosy Baeckea	1	100	3	250	2	50																			2	50	10	100		
Myrtaceae	*Leptospermum arachnoides*																															
Myrtaceae	*Leptospermum juniperinum*	Prickly Tea- tree																														
Myrtaceae	*Leptospermum laevigatum*	Coast Teatree																			1	20			20	100						
Myrtaceae	*Leptospermum polygalifolium* subsp. *cismontanum*	Tantoon	5	20	5	20	20	50															1	1					5	10		
Myrtaceae	*Leptospermum trinervium*	Flaky-barked Tea-tree	30	50	30	50	10	100	5	20									1	2							40	100	30	100	20	80
Myrtaceae	*Melaleuca decora*		1	5																												
Myrtaceae	*Melaleuca ericifolia*	Swamp Paperbark																														
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark																														
Myrtaceae	*Melaleuca nodosa*	Prickly- leaved Paperbark	30	30	15	20	50	100			2	2															40	50	60	100	20	110
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark															2	2														
Myrtaceae	*Melaleuca sieberi*						5	20																								
Myrtaceae	*Melaleuca thymifolia*	Thyme Honey- myrtle					10	50																								
Myrtaceae	*Micromyrtus ciliata*	Heath- myrtle	1	50	1	50	1	1																			1	10	1	10	2	45
Orchidaceae	*Acianthus fornicatus*	Pixie Caps	1	5			1	100	1	1000	1	20	1	20	5	400	1	15									1	500				
Orchidaceae	*Chiloglottis sp.*										1	20																				
Orchidaceae	*Pterostylis longifolia*	Tall Greenhood					1	100																					1	10		
Orchidaceae	*Pterostylis mutica*	Midget Greenhood																									1	10				
Phormiaceae	*Dianella caerulea*	Blue Flax-lily			3	50	1	1	1	10	10	500			5	60	2	40					5	120	2	500			1	10		
Phormiaceae	*Dianella longifolia*								1	10																						
Phyllanthaceae	*Billardiera scandens*	Hairy Apple Berry					1	2							1	2							1	1								
Picrodendraceae	*Pseudanthus orientalis*						1	1																								
Pinaceae	**Pinus elliottii*	Slash Pine																														
Pinaceae	**Pinus radiata*	Radiata Pine																														
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum																														
Poaceae	**Andropogon virginicus*	Whisky Grass															1	2														
Poaceae	**Axonopus fissifolius*	Narrow-leafed Carpet Grass																														
Poaceae	**Ehrharta erecta*	Panic Veldtgrass																														
Poaceae	**Eragrostis cilianensis*	Stinkgrass																														
Poaceae	**Eragrostis curvula*	African Love Grass									2	10											1	2	30	1000						
Poaceae	**Melinis repens*	Red Natal Grass																							5	100						
Poaceae	**Paspalum dilatatum*	Paspalum																														
Poaceae	**Pennisetum clandestinum*	Kikuyu Grass																														
Poaceae	**Setaria parviflora*																															
Poaceae	**Setaria pumila*	Pale Pigeon Grass																														
Poaceae	**Setaria sphacelata*	South African Pigeon Grass																														
Poaceae	*Anisopogon avenaceus*	Oat Speargrass																														
Poaceae	*Austrostipa pubescens*																															
Poaceae	*Cynodon dactylon*	Couch																														
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog Grass																														
Poaceae	*Entolasia marginata*	Bordered Panic																														
Poaceae	*Entolasia stricta*	Wiry Panic	5	1000							1	20					2	30									1	10				
Poaceae	*Eragrostis brownii*	Brown's Lovegrass													1	20																
Poaceae	*Hemarthria uncinata* var. *uncinata*	Mat Grass																														
Poaceae	*Imperata cylindrica*	Blady Grass									10	100	1	50	1	10									1	50						
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Grass																														
Poaceae	*Panicum simile*	Two-colour Panic															1	1														

Offset Site

Quadrat Number			Q12		Q13		Q14		Q15		Q16		Q17		Q18		Q19		Q20		Q21		Q22		Q23		Q24		Q25		Q26	
Vegetation Code			HU917		HU917		HU917		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU860		HU851		HU851		HU851	
Condition/ Zone			Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Rehab		Rehab		Rehab		Regen		Mod-Good		Mod-Good		Mod-Good	
Easting			387747		388164		388931		387759		387583		388853		389029		389209		387603		387569		387696		387650		388019		388302		388406	
Northing			6369950		6369730		6369769		6369788		6369215		6369410		6369288		6369358		6369638		6369434		6369249		6369163		6369804		6369727		6369600	
Family	Scientific Name	Common Name	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	s	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Poaceae	*Paspalidium distans*		1	1													2	30														
Poaceae	*Paspalidium sp.*																2	30														
Poaceae	*Themeda triandra*	Kangaroo Grass													1	2																
Polygalaceae	*Comesperma ericinum*	Pyramid Flower																														
Polygonaceae	*Persicaria decipiens*	Slender Knotweed																														
Proteaceae	*Banksia aemula*	Wallum Banksia	40	20	30	50	50	100																			30	30	60	100	15	80
Proteaceae	*Banksia oblongifolia*		1	20			20	50											1	1							1	20			1	5
Proteaceae	*Banksia serrata*	Old Man Banksia							20	20	20	10	5	5	6	40	1	20	2	8	1	1	1	2	20	15						
Proteaceae	*Conospermum taxifolium*	Variable Smoke-bush													1	10	1	5					1	10	1	1						
Proteaceae	*Hakea sericea*	Needlebush					1	5																								
Proteaceae	*Hakea teretifolia*	Needlebush																														
Proteaceae	*Isopogon anemonifolius*	Broad- leaf Drumsticks	1	20	5	20	5	20															1	2			1	20	2	5	3	30
Proteaceae	*Lambertia formosa*	Mountain Devils	10	10																							20	50			10	45
Proteaceae	*Persoonia lanceolata*	Lance Leaf Geebung	1	10	1	10	1	5	1	100	1	2							1	20	1	10	5	80	1	10			1	5	1	20
Proteaceae	*Persoonia levis*	Broad-leaved Geebung	1	1							1	4	1	2									1	1	1	50	1	10			1	20
Proteaceae	*Petrophile pulchella*	Drumsticks																													1	15
Pteridaceae	*Cheilanthes sieberi*																								1	2						
Restionaceae	*Baloskion pallens*												40	1000																		
Restionaceae	*Baloskion sp.*																															
Restionaceae	*Baloskion tetraphyllum* subsp. *meiostachyum*	Plume Rush															60	220														
Restionaceae	*Empodisma minus*	Spreading Rope- rush																														
Restionaceae	*Eurychorda complanata*		1	30			1	50																								
Restionaceae	*Hypolaena fastigiata*		1	100	1	10	1	10																			1	100	1	50		
Restionaceae	*Leptocarpus tenax*		1	50			10	500																			1	100			2	80
Restionaceae	*Lepyrodia muelleri*																															
Restionaceae	*Lepyrodia scariosa*						10	500																							2	70
Rubiaceae	**Richardia brasiliensis*	White Eye																														
Rubiaceae	*Pomax umbellata*										20	500	1	50	3	60	1	20			2	50	1	15	1	50						
Rutaceae	*Eriostemon australasius*	Pink Wax Flower			3	20			2	10																	1	20	2	5	1	15
Rutaceae	*Zieria laxiflora*	Wallum Zieria																											1	1		
Selaginellaceae	*Selaginella uliginosa*	Swamp Selaginella			1	20							1	10			1	5														
Solanaceae	**Solanum pseudocapsicum*	Jerusalem Cherry																														
Stylidiaceae	*Stylidium graminifolium*	Grass Trigger Plant																														
Thymelaeaceae	*Pimelea linifolia subsp. linifolia*	Slender Rice-flower	1	100	1	20			1	100	1	10			1	10											1	50	2	50	3	50
Verbenaceae	**Lantana camara*	Lantana																														
Verbenaceae	**Verbena bonariensis*	Purpletop																														
Violaceae	*Viola hederacea*	Ivy-leaved Violet																														
Xanthorrhoeaceae	*Xanthorrhoea glauca*								30	100	1	2															1	2				
Xanthorrhoeaceae	*Xanthorrhoea minor*														1	4																
Xyridaceae	*Xyris gracilis*																															
Zamiaceae	*Macrozamia communis*	Burrawang									1	3			1	5							1	1								
		Total Species Richness	**33**		**32**		**38**		**31**		**35**		**18**		**34**		**34**		**31**		**32**		**39**		**33**		**40**		**31**		**38**	

* Denotes Introducted Species

# Denotes Threatened Species (Listed under TSC Act and/ or EPBC)

Offset Site

Quadrat Number			Q27		Q28		Q29		Q30		Q31		Q32		Q33		Q34		Q35		Q36		Q37		Q38		Q39	
Vegetation Code			HU851		HU851		HU865		HU865		HU865		HU938		HU938		HU938		HU938		HU938		HU938		HU938		HU938	
Condition/ Zone			Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Regen		Regen		Regen		Regen	
Easting			388601		389068		388538		388641		388767		388005		388048		388881		389033		388353		388759		389008		389080	
Northing			6369505		6369729		6369837		6369726		6369745		6369088		6368778		6369053		6369501		6369172		6369254		6369094		6369112	
Family	Scientific Name	Common Name	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Anthericaceae	*Tricoryne simplex*																											
Apiaceae	*Centella asiatica*	Indian Pennywort																										
Apiaceae	*Platysace ericoides*		1	20	3	50	10	500																				
Apiaceae	*Trachymene incisa*				2	100	2	100	1	20	1	50																
Apocynaceae	*Gomphocarpus fruticosus*	Narrow- leaved Cottonbush																										
Apocynaceae	*Marsdenia suaveolens*	Scented Marsdenia																										
Apocynaceae	*Parsonsia straminea*	Common Silkpod											1	5	1	20												
Asteraceae	**Bidens pilosa*	Cobblers Pegs																										
Asteraceae	**Conyza bonariensis*	Flaxleaf Fleabane																					1	10				
Asteraceae	**Hypochaeris radicata*	Catsear																										
Asteraceae	**Senecio madagascariensis*	Fireweed																					1	4			1	1
Asteraceae	*Actinotus helianthi*	Flannel Flower	1	10			1	10																				
Asteraceae	*Ozothamnus diosmifolius*	Rice Flower																					1	5	2	10		
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	Wonga Wonga Vine	1	5	1	5																						
Blandfordiaceae	*Blandfordia nobilis*	Christmas Bells																										
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern											4	80														
Blechnaceae	*Blechnum indicum*	Swamp Water Fern													40	320	10	50										
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak																										
Casuarinaceae	*Casuarina glauca*	Swamp Oak																									35	120
Commelinaceae	*Commelina cyanea*																											
Cyperaceae	**Isolepis prolifera*																											
Cyperaceae	*Baumea articulata*	Jointed Twig-rush															1	10	20	1000								
Cyperaceae	*Baumea rubiginosa*																		5	200								
Cyperaceae	*Baumea sp.*														1	3												
Cyperaceae	*Baumea teretifolia*																											
Cyperaceae	*Caustis pentandra*																											
Cyperaceae	*Caustis recurvata*				1	2																						
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge							1	5			2	15	2	20									1	1		
Cyperaceae	*Gahnia sieberiana*	Red-fruit Saw-sedge											3	40			80	240			1	10						
Cyperaceae	*Lepidosperma laterale*																											
Cyperaceae	*Ptilothrix deusta*						2	100			2	100																
Cyperaceae	*Schoenus brevifolius*	Zig- zag Bog- rush					1	5	70	1000	2	500							50	1000								
Cyperaceae	*Schoenus ericetorum*	Heath Bog-rush			2	40																						
Dennstaedtiaceae	*Histiopteris incisa*	Bat's Wing Fern											4	110														
Dennstaedtiaceae	*Pteridium esculentum*	Common Bracken	20	250									4	140			1	15			50	200			15	120		
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern											4	120														
Dilleniaceae	*Hibbertia acicularis*																											
Dilleniaceae	*Hibbertia fasciculata*				1	5																						
Dilleniaceae	*Hibbertia linearis*		2	20																								
Droseraceae	*Drosera auriculata*										1	500																
Droseraceae	*Drosera binata*	Forked Sundew																										
Droseraceae	*Drosera peltata*								1	50																		
Elaeocarpaceae	*Tetratheca thymifolia*	Thyme Pink-bells			1	10																						
Ericaceae - Epacridoideae	*Astroloma pinifolium*	Pine Heath																			1	6						
Ericaceae - Epacridoideae	*Brachyloma daphnoides*	Daphne Heath																										
Ericaceae - Epacridoideae	*Epacris obtusifolia*	Blunt- leaf Heath																										
Ericaceae - Epacridoideae	*Epacris pulchella*	Wallum Heath									1	10																
Ericaceae - Epacridoideae	*Leucopogon appressus*																											
Ericaceae - Epacridoideae	*Leucopogon ericoides*	Pink Beard-heath			1	50																						
Ericaceae - Epacridoideae	*Leucopogon esquamatus*				1	1	1	1																				
Ericaceae - Epacridoideae	*Leucopogon juniperinus*	Prickly Beard-heath									40	500																
Ericaceae - Epacridoideae	*Leucopogon lanceolatus* var. *lanceolatus*																											
Ericaceae - Epacridoideae	*Leucopogon leptospermoides*		5	20																								
Ericaceae - Epacridoideae	*Leucopogon virgatus*																											
Ericaceae - Epacridoideae	*Monotoca elliptica*	Tree Broom-heath	1	10			1	5					1	20							1	15						
Ericaceae - Epacridoideae	*Monotoca scoparia*						1	5																				

Offset Site

Quadrat Number			Q27		Q28		Q29		Q30		Q31		Q32		Q33		Q34		Q35		Q36		Q37		Q38		Q39	
Vegetation Code			HU851		HU851		HU865		HU865		HU865		HU938		HU938		HU938		HU938		HU938		HU938		HU938		HU938	
Condition/ Zone			Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Regen		Regen		Regen		Regen	
Easting			388601		389068		388538		388641		388767		388005		388048		388881		389033		388353		388759		389008		389080	
Northing			6369505		6369729		6369837		6369726		6369745		6369088		6368778		6369053		6369501		6369172		6369254		6369094		6369112	
Family	Scientific Name	Common Name	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Ericaceae - Epacridoideae	*Styphelia viridis*	Green Five-corners																										
Ericaceae - Epacridoideae	*Woollsia pungens*																											
Euphorbiaceae	*Amperea xiphoclada* var. *xiphoclada*		3	50	3	50																						
Euphorbiaceae	*Homalanthus populifolius*	Bleeding Heart																									1	1
Euphorbiaceae	*Ricinocarpos pinifolius*	Wedding Bush			2	10																						
Fabaceae - Faboideae	*Almaleea paludosa*								1	20																		
Fabaceae - Faboideae	*Aotus ericoides*		1	5	4	20																						
Fabaceae - Faboideae	*Bossiaea ensata*	Sword Bossiaea																										
Fabaceae - Faboideae	*Bossiaea heterophylla*	Variable Bossiaea	1	5	5	100	5	50																				
Fabaceae - Faboideae	*Bossiaea obcordata*	Spiny Bossiaea																										
Fabaceae - Faboideae	*Bossiaea rhombifolia*						1	1																				
Fabaceae - Faboideae	*Daviesia ulicifolia*	Gorse Bitter Pea																										
Fabaceae - Faboideae	*Dillwynia floribunda*				1	1																						
Fabaceae - Faboideae	*Dillwynia retorta*		2	10																								
Fabaceae - Faboideae	*Glycine microphylla*	Small- leaf Glycine																										
Fabaceae - Faboideae	*Glycine tabacina*																											
Fabaceae - Faboideae	*Gompholobium latifolium*	Golden Glory Pea																										
Fabaceae - Faboideae	*Gompholobium virgatum*	Leafy Wedge Pea																										
Fabaceae - Faboideae	*Hardenbergia violacea*	Purple Coral Pea																										
Fabaceae - Faboideae	*Indigofera australis*	Australian Indigo																										
Fabaceae - Faboideae	*Kennedia rubicunda*	Dusky Coral Pea											15	100	1	15									1	3		
Fabaceae - Faboideae	*Mirbelia rubiifolia*	Heathy Mirbelia					1	1	10	250	40	500																
Fabaceae - Faboideae	*Pultenaea retusa*	Notched Bush- pea					1	3	2	50															1	1		
Fabaceae - Faboideae	*Viminaria juncea*	Golden Spray											1	6									3	30	1	2		
Fabaceae - Mimosoideae	**Acacia saligna*	Golden Wreath Wattle																									1	6
Fabaceae - Mimosoideae	*Acacia brownii*	Prickly Moses			2	5	1	1																				
Fabaceae - Mimosoideae	*Acacia elongata*	Swamp Wattle							1	20			1	3							1	7	4	25	30	120		
Fabaceae - Mimosoideae	*Acacia floribunda*	White Sally Wattle																										
Fabaceae - Mimosoideae	*Acacia longifolia* subsp. *longifolia*	Sydney Golden Wattle	1	2	2	10			1	5	2	10	45	280	1	7	1	1			10	40	5	40	40	200	5	30
Fabaceae - Mimosoideae	*Acacia stricta*	Straight Wattle																	1	2								
Fabaceae - Mimosoideae	*Acacia suaveolens*	Sweet Wattle					1	1													1	1						
Fabaceae - Mimosoideae	*Acacia terminalis var. Long inflorescences (P.G.Kodela 307)*	Sunshine Wattle																										
Fabaceae - Mimosoideae	*Acacia ulicifolia*	Prickly Moses	1	5																								
Gleicheniaceae	*Gleichenia dicarpa*	Pouched Coral Fern																										
Goodeniaceae	*Dampiera stricta*						2	100																	1	1		
Goodeniaceae	*Goodenia bellidifolia*								1	20																		
Haemodoraceae	*Haemodorum planifolium*						2	100			2	100																
Haloragaceae	*Gonocarpus micranthus subsp. micranthus*								1	50									1	10	1	3	1	3				
Haloragaceae	*Gonocarpus teucrioides*	Raspwort																										
Hydrocharitaceae	*Ottelia ovalifolia*	Swamp Lily																	1	50								
Iridaceae	*Patersonia sericea*	Silky Purple-flag																										
Juncaceae	*Juncus continuus*																											
Juncaceae	*Juncus usitatus*																1	20										
Lauraceae	*Cassytha glabella*				1	10					1	10							1	10								
Lauraceae	*Cassytha pubescens*		1	5					1	10																		
Loganiaceae	*Mitrasacme polymorpha*																											
Lomandraceae	*Lomandra confertifolia*	Mat- rush																										
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Wattle Mat-rush			1	1																						
Lomandraceae	*Lomandra glauca*	Pale Mat-rush	1	10																								
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	1	10	1	10																						
Lomandraceae	*Lomandra micrantha*	Small- flower Mat- rush																										
Malvaceae	**Sida rhombifolia*	Paddy's Lucerne																										
Menyanthaceae	*Liparophyllum exaltatum*																											
Myrtaceae	*# Eucalyptus camfieldii*	Camfield's Stringybark																										
Myrtaceae	*Angophora costata*	Smooth-barked Apple	10	4	2	1																						
Myrtaceae	*Callistemon citrinus*	Crimson Bottlebrush							1	2											1	1						

Offset Site

Quadrat Number			Q27		Q28		Q29		Q30		Q31		Q32		Q33		Q34		Q35		Q36		Q37		Q38		Q39	
Vegetation Code			HU851		HU851		HU865		HU865		HU865		HU938		HU938		HU938		HU938		HU938		HU938		HU938		HU938	
Condition/ Zone			Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Regen		Regen		Regen		Regen	
Easting			388601		389068		388538		388641		388767		388005		388048		388881		389033		388353		388759		389008		389080	
Northing			6369505		6369729		6369837		6369726		6369745		6369088		6368778		6369053		6369501		6369172		6369254		6369094		6369112	
Family	Scientific Name	Common Name	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Myrtaceae	*Callistemon pachyphyllus*	Wallum Bottlebrush					1	3	1	3																		
Myrtaceae	*Callistemon sp.*																						1	25				
Myrtaceae	*Corymbia gummifera*	Red Bloodwood																										
Myrtaceae	*Eucalyptus globoidea*	White Stringybark			40	40																						
Myrtaceae	# *Eucalyptus parramattensis* subsp. *decadens*						30	22	15	8	5	5																
Myrtaceae	*Eucalyptus pilularis*	Blackbutt																										
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint					2	1			10	15																
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany											50	27	35	16	5	3	2	2	15	4	3	3	10	70	1	15
Myrtaceae	*Eucalyptus signata*	Scribbly Gum	50	20					20	6	2	2																
Myrtaceae	*Euryomyrtus ramosissima*	Rosy Baeckea			2	20															1	4						
Myrtaceae	*Leptospermum arachnoides*								3	50	2	100																
Myrtaceae	*Leptospermum juniperinum*	Prickly Tea- tree																	1	2			2	30	1	3		
Myrtaceae	*Leptospermum laevigatum*	Coast Teatree																			1	25	1	2				
Myrtaceae	*Leptospermum polygalifolium* subsp. *cismontanum*	Tantoon	5	20	10	100	5	20	1	3	10	50																
Myrtaceae	*Leptospermum trinervium*	Flaky-barked Tea-tree	5	10	15	50	5	10			15	50																
Myrtaceae	*Melaleuca decora*																											
Myrtaceae	*Melaleuca ericifolia*	Swamp Paperbark																									1	1
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark																							1	5		
Myrtaceae	*Melaleuca nodosa*	Prickly- leaved Paperbark	10	20	40	100	5	5																			1	1
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark							2	1	1	2	2	3	25	14	15	20	20	38			2	4	1	15	2	10
Myrtaceae	*Melaleuca sieberi*						1	5																				
Myrtaceae	*Melaleuca thymifolia*	Thyme Honey- myrtle					5	100	2	20	5	50							1	1								
Myrtaceae	*Micromyrtus ciliata*	Heath- myrtle			1	5	1	2																				
Orchidaceae	*Acianthus fornicatus*	Pixie Caps			1	1000																						
Orchidaceae	*Chiloglottis sp.*																											
Orchidaceae	*Pterostylis longifolia*	Tall Greenhood																										
Orchidaceae	*Pterostylis mutica*	Midget Greenhood																										
Phormiaceae	*Dianella caerulea*	Blue Flax-lily			1	20			1	5			1	30							1	20	2	40				
Phormiaceae	*Dianella longifolia*						1	1							1	4												
Phyllanthaceae	*Billardiera scandens*	Hairy Apple Berry			1	2	1	2																				
Picrodendraceae	*Pseudanthus orientalis*																								1	2		
Pinaceae	**Pinus elliottii*	Slash Pine									1	1																
Pinaceae	**Pinus radiata*	Radiata Pine																									3	6
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum																										
Poaceae	**Andropogon virginicus*	Whisky Grass							1	20			1	4									25	180	5	25	5	60
Poaceae	**Axonopus fissifolius*	Narrow-leafed Carpet Grass																					1	15	1	5	1	10
Poaceae	**Ehrharta erecta*	Panic Veldtgrass																									1	20
Poaceae	**Eragrostis cilianensis*	Stinkgrass																										
Poaceae	**Eragrostis curvula*	African Love Grass																					20	100	10	50	30	140
Poaceae	**Melinis repens*	Red Natal Grass																					5	40			5	60
Poaceae	**Paspalum dilatatum*	Paspalum																										
Poaceae	**Pennisetum clandestinum*	Kikuyu Grass																										
Poaceae	**Setaria parviflora*																											
Poaceae	**Setaria pumila*	Pale Pigeon Grass																										
Poaceae	**Setaria sphacelata*	South African Pigeon Grass											1	5									25	150	15	100	10	40
Poaceae	*Anisopogon avenaceus*	Oat Speargrass																										
Poaceae	*Austrostipa pubescens*						1	10																				
Poaceae	*Cynodon dactylon*	Couch					1	10							1	15									1	10	3	20
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog Grass																										
Poaceae	*Entolasia marginata*	Bordered Panic					2	50							1	10												
Poaceae	*Entolasia stricta*	Wiry Panic							2	50					1	10					1	5			2	30		
Poaceae	*Eragrostis brownii*	Brown's Lovegrass					**1**	**10**			1	1									1	25	3	30	5	50	1	20
Poaceae	*Hemarthria uncinata* var. *uncinata*	Mat Grass							3	100																		
Poaceae	*Imperata cylindrica*	Blady Grass					5	500																				
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Grass																										
Poaceae	*Panicum simile*	Two-colour Panic																										

Offset Site

Quadrat Number			Q27		Q28		Q29		Q30		Q31		Q32		Q33		Q34		Q35		Q36		Q37		Q38		Q39	
Vegetation Code			HU851		HU851		HU865		HU865		HU865		HU938		HU938		HU938		HU938		HU938		HU938		HU938		HU938	
Condition/ Zone			Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Mod-Good		Regen		Regen		Regen		Regen	
Easting			388601		389068		388538		388641		388767		388005		388048		388881		389033		388353		388759		389008		389080	
Northing			6369505		6369729		6369837		6369726		6369745		6369088		6368778		6369053		6369501		6369172		6369254		6369094		6369112	
Family	Scientific Name	Common Name	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Poaceae	*Paspalidium distans*														1	25									1	15		
Poaceae	*Paspalidium sp.*																											
Poaceae	*Themeda triandra*	Kangaroo Grass																										
Polygalaceae	*Comesperma ericinum*	Pyramid Flower									1	50																
Polygonaceae	*Persicaria decipiens*	Slender Knotweed																										
Proteaceae	*Banksia aemula*	Wallum Banksia	10	20																								
Proteaceae	*Banksia oblongifolia*						2	30	2	3	5	250													2	1		
Proteaceae	*Banksia serrata*	Old Man Banksia			20	20	2	10															1	1				
Proteaceae	*Conospermum taxifolium*	Variable Smoke-bush									1	50																
Proteaceae	*Hakea sericea*	Needlebush							1	10	10	500																
Proteaceae	*Hakea teretifolia*	Needlebush							1	20									1	2								
Proteaceae	*Isopogon anemonifolius*	Broad- leaf Drumsticks	5	10	4	5	1	1																				
Proteaceae	*Lambertia formosa*	Mountain Devils			1	1																						
Proteaceae	*Persoonia lanceolata*	Lance Leaf Geebung							1	3	1	50	1	15							1	20	1	40				
Proteaceae	*Persoonia levis*	Broad-leaved Geebung	1	10	2	10	2	50	1	2	2	2									2	30			1	60		
Proteaceae	*Petrophile pulchella*	Drumsticks					1	10	1	10	1	100																
Pteridaceae	*Cheilanthes sieberi*																											
Restionaceae	*Baloskion pallens*																											
Restionaceae	*Baloskion sp.*				1	10	1	50																				
Restionaceae	*Baloskion tetraphyllum* subsp. *meiostachyum*	Plume Rush											3	60	50	300	20	80										
Restionaceae	*Empodisma minus*	Spreading Rope- rush																										
Restionaceae	*Eurychorda complanata*						2	100			2	1000																
Restionaceae	*Hypolaena fastigiata*				2	10																						
Restionaceae	*Leptocarpus tenax*						20	1000	50	1000	1	100																
Restionaceae	*Lepyrodia muelleri*																											
Restionaceae	*Lepyrodia scariosa*						3	50	5	100	4	1000																
Rubiaceae	**Richardia brasiliensis*	White Eye																									2	20
Rubiaceae	*Pomax umbellata*		1	10	1	10															1	5			1	4		
Rutaceae	*Eriostemon australasius*	Pink Wax Flower	5	20																								
Rutaceae	*Zieria laxiflora*	Wallum Zieria			1	3																						
Selaginellaceae	*Selaginella uliginosa*	Swamp Selaginella							1	20																		
Solanaceae	**Solanum pseudocapsicum*	Jerusalem Cherry																										
Stylidiaceae	*Stylidium graminifolium*	Grass Trigger Plant									1	100																
Thymelaeaceae	*Pimelea linifolia subsp. linifolia*	Slender Rice-flower	1	5	1	10																						
Verbenaceae	**Lantana camara*	Lantana																									1	2
Verbenaceae	**Verbena bonariensis*	Purpletop																										
Violaceae	*Viola hederacea*	Ivy-leaved Violet																										
Xanthorrhoeaceae	*Xanthorrhoea glauca*		1	5																								
Xanthorrhoeaceae	*Xanthorrhoea minor*						1	1																				
Xyridaceae	*Xyris gracilis*																											
Zamiaceae	*Macrozamia communis*	Burrawang																										
		Total Species Richness	**28**		**38**		**42**		**33**		**31**		**19**		**14**		**9**		**12**		**18**		**21**		**25**		**20**	

* Denotes Introducted Species

# Denotes Threatened Species (Listed under TSC Act and/ or EPBC)

Offset Site

Quadrat Number			Q40		Q41		Q42		Q43		Q44		Q45	
Vegetation Code			HU938		HU938		HU938		HU948		HU948		HU948	
Condition/ Zone			Regen		Regen		Regen		Mod-Good		Mod-Good		Mod-Good	
Easting			389219		389180		389105		388248		388523		388566	
Northing			6369229		6369104		6368731		6369086		6369144		6369226	
Family	Scientific Name	Common Name	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Anthericaceae	*Tricoryne simplex*													
Apiaceae	*Centella asiatica*	Indian Pennywort	1	25										
Apiaceae	*Platysace ericoides*													
Apiaceae	*Trachymene incisa*													
Apocynaceae	*Gomphocarpus fruticosus*	Narrow- leaved Cottonbush	1	5										
Apocynaceae	*Marsdenia suaveolens*	Scented Marsdenia												
Apocynaceae	*Parsonsia straminea*	Common Silkpod	1	20										
Asteraceae	**Bidens pilosa*	Cobblers Pegs	1	30										
Asteraceae	**Conyza bonariensis*	Flaxleaf Fleabane	1	10	1	10								
Asteraceae	**Hypochaeris radicata*	Catsear	1	25										
Asteraceae	**Senecio madagascariensis*	Fireweed	1	30										
Asteraceae	*Actinotus helianthi*	Flannel Flower												
Asteraceae	*Ozothamnus diosmifolius*	Rice Flower												
Bignoniaceae	*Pandorea pandorana* subsp. *pandorana*	Wonga Wonga Vine	1	5	1	1								
Blandfordiaceae	*Blandfordia nobilis*	Christmas Bells												
Blechnaceae	*Blechnum cartilagineum*	Gristle Fern												
Blechnaceae	*Blechnum indicum*	Swamp Water Fern	5	40							5	50	10	250
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak												
Casuarinaceae	*Casuarina glauca*	Swamp Oak	1	30	1	1								
Commelinaceae	*Commelina cyanea*													
Cyperaceae	**Isolepis prolifera*						5	160						
Cyperaceae	*Baumea articulata*	Jointed Twig-rush							5	50	1	20	80	1000
Cyperaceae	*Baumea rubiginosa*								15	100				
Cyperaceae	*Baumea sp.*													
Cyperaceae	*Baumea teretifolia*										5	50		
Cyperaceae	*Caustis pentandra*													
Cyperaceae	*Caustis recurvata*													
Cyperaceae	*Gahnia clarkei*	Tall Saw-sedge	45	60					50	100	90	250	25	100
Cyperaceae	*Gahnia sieberiana*	Red-fruit Saw-sedge												
Cyperaceae	*Lepidosperma laterale*													
Cyperaceae	*Ptilothrix deusta*													
Cyperaceae	*Schoenus brevifolius*	Zig- zag Bog- rush							2	20			2	20
Cyperaceae	*Schoenus ericetorum*	Heath Bog-rush												
Dennstaedtiaceae	*Histiopteris incisa*	Bat's Wing Fern	1	1										
Dennstaedtiaceae	*Pteridium esculentum*	Common Bracken	3	60	15	130							2	20
Dicksoniaceae	*Calochlaena dubia*	Rainbow Fern	2	80										
Dilleniaceae	*Hibbertia acicularis*													
Dilleniaceae	*Hibbertia fasciculata*													
Dilleniaceae	*Hibbertia linearis*													
Droseraceae	*Drosera auriculata*													
Droseraceae	*Drosera binata*	Forked Sundew							1	20			1	10
Droseraceae	*Drosera peltata*													
Elaeocarpaceae	*Tetratheca thymifolia*	Thyme Pink-bells												
Ericaceae - Epacridoideae	*Astroloma pinifolium*	Pine Heath												
Ericaceae - Epacridoideae	*Brachyloma daphnoides*	Daphne Heath												
Ericaceae - Epacridoideae	*Epacris obtusifolia*	Blunt- leaf Heath							1	20				
Ericaceae - Epacridoideae	*Epacris pulchella*	Wallum Heath												
Ericaceae - Epacridoideae	*Leucopogon appressus*													
Ericaceae - Epacridoideae	*Leucopogon ericoides*	Pink Beard-heath												
Ericaceae - Epacridoideae	*Leucopogon esquamatus*													
Ericaceae - Epacridoideae	*Leucopogon juniperinus*	Prickly Beard-heath												
Ericaceae - Epacridoideae	*Leucopogon lanceolatus* var. *lanceolatus*													
Ericaceae - Epacridoideae	*Leucopogon leptospermoides*													
Ericaceae - Epacridoideae	*Leucopogon virgatus*													
Ericaceae - Epacridoideae	*Monotoca elliptica*	Tree Broom-heath												
Ericaceae - Epacridoideae	*Monotoca scoparia*													

Offset Site

Quadrat Number			Q40		Q41		Q42		Q43		Q44		Q45	
Vegetation Code			HU938		HU938		HU938		HU948		HU948		HU948	
Condition/ Zone			Regen		Regen		Regen		Mod-Good		Mod-Good		Mod-Good	
Easting			389219		389180		389105		388248		388523		388566	
Northing			6369229		6369104		6368731		6369086		6369144		6369226	
Family	**Scientific Name**	**Common Name**	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Ericaceae - Epacridoideae	*Styphelia viridis*	Green Five-corners												
Ericaceae - Epacridoideae	*Woollsia pungens*													
Euphorbiaceae	*Amperea xiphoclada* var. *xiphoclada*													
Euphorbiaceae	*Homalanthus populifolius*	Bleeding Heart												
Euphorbiaceae	*Ricinocarpos pinifolius*	Wedding Bush												
Fabaceae - Faboideae	*Almaleea paludosa*													
Fabaceae - Faboideae	*Aotus ericoides*													
Fabaceae - Faboideae	*Bossiaea ensata*	Sword Bossiaea												
Fabaceae - Faboideae	*Bossiaea heterophylla*	Variable Bossiaea												
Fabaceae - Faboideae	*Bossiaea obcordata*	Spiny Bossiaea												
Fabaceae - Faboideae	*Bossiaea rhombifolia*													
Fabaceae - Faboideae	*Daviesia ulicifolia*	Gorse Bitter Pea												
Fabaceae - Faboideae	*Dillwynia floribunda*													
Fabaceae - Faboideae	*Dillwynia retorta*													
Fabaceae - Faboideae	*Glycine microphylla*	Small- leaf Glycine												
Fabaceae - Faboideae	*Glycine tabacina*													
Fabaceae - Faboideae	*Gompholobium latifolium*	Golden Glory Pea												
Fabaceae - Faboideae	*Gompholobium virgatum*	Leafy Wedge Pea												
Fabaceae - Faboideae	*Hardenbergia violacea*	Purple Coral Pea												
Fabaceae - Faboideae	*Indigofera australis*	Australian Indigo												
Fabaceae - Faboideae	*Kennedia rubicunda*	Dusky Coral Pea	1	30										
Fabaceae - Faboideae	*Mirbelia rubiifolia*	Heathy Mirbelia												
Fabaceae - Faboideae	*Pultenaea retusa*	Notched Bush- pea	1	2										
Fabaceae - Faboideae	*Viminaria juncea*	Golden Spray			1	1			1	10			10	50
Fabaceae - Mimosoideae	**Acacia saligna*	Golden Wreath Wattle												
Fabaceae - Mimosoideae	*Acacia brownii*	Prickly Moses												
Fabaceae - Mimosoideae	*Acacia elongata*	Swamp Wattle			3	10			1	20			1	10
Fabaceae - Mimosoideae	*Acacia floribunda*	White Sally Wattle												
Fabaceae - Mimosoideae	*Acacia longifolia* subsp. *longifolia*	Sydney Golden Wattle	2	5	65	200							1	5
Fabaceae - Mimosoideae	*Acacia stricta*	Straight Wattle												
Fabaceae - Mimosoideae	*Acacia suaveolens*	Sweet Wattle												
Fabaceae - Mimosoideae	*Acacia terminalis var. Long inflorescences (P.G.Kodela 307)*	Sunshine Wattle												
Fabaceae - Mimosoideae	*Acacia ulicifolia*	Prickly Moses												
Gleicheniaceae	*Gleichenia dicarpa*	Pouched Coral Fern									5	50	1	10
Goodeniaceae	*Dampiera stricta*													
Goodeniaceae	*Goodenia bellidifolia*													
Haemodoraceae	*Haemodorum planifolium*													
Haloragaceae	*Gonocarpus micranthus subsp. micranthus*				1	2								
Haloragaceae	*Gonocarpus teucrioides*	Raspwort												
Hydrocharitaceae	*Ottelia ovalifolia*	Swamp Lily												
Iridaceae	*Patersonia sericea*	Silky Purple-flag												
Juncaceae	*Juncus continuus*		1	10			5	30					1	5
Juncaceae	*Juncus usitatus*		1	5										
Lauraceae	*Cassytha glabella*								10	50				
Lauraceae	*Cassytha pubescens*													
Loganiaceae	*Mitrasacme polymorpha*													
Lomandraceae	*Lomandra confertifolia*	Mat- rush												
Lomandraceae	*Lomandra filiformis* subsp. *filiformis*	Wattle Mat-rush												
Lomandraceae	*Lomandra glauca*	Pale Mat-rush												
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	1	10										
Lomandraceae	*Lomandra micrantha*	Small- flower Mat- rush												
Malvaceae	**Sida rhombifolia*	Paddy's Lucerne	1	10										
Menyanthaceae	*Liparophyllum exaltatum*						15	240	1	10				
Myrtaceae	*#Eucalyptus camfieldii*	Camfield's Stringybark												
Myrtaceae	*Angophora costata*	Smooth-barked Apple	30	12										
Myrtaceae	*Callistemon citrinus*	Crimson Bottlebrush							65	100	2	5	2	10

Offset Site

Quadrat Number			Q40		Q41		Q42		Q43		Q44		Q45	
Vegetation Code			HU938		HU938		HU938		HU948		HU948		HU948	
Condition/ Zone			Regen		Regen		Regen		Mod-Good		Mod-Good		Mod-Good	
Easting			389219		389180		389105		388248		388523		388566	
Northing			6369229		6369104		6368731		6369086		6369144		6369226	
Family	Scientific Name	Common Name	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Myrtaceae	*Callistemon pachyphyllus*	Wallum Bottlebrush												
Myrtaceae	*Callistemon sp.*													
Myrtaceae	*Corymbia gummifera*	Red Bloodwood												
Myrtaceae	*Eucalyptus globoidea*	White Stringybark												
Myrtaceae	# *Eucalyptus parramattensis* subsp. *decadens*													
Myrtaceae	*Eucalyptus pilularis*	Blackbutt												
Myrtaceae	*Eucalyptus piperita*	Sydney Peppermint												
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany	4	2	5	2			1	3				
Myrtaceae	*Eucalyptus signata*	Scribbly Gum												
Myrtaceae	*Euryomyrtus ramosissima*	Rosy Baeckea												
Myrtaceae	*Leptospermum arachnoides*								1	5				
Myrtaceae	*Leptospermum juniperinum*	Prickly Tea- tree			1	2			1	3	30	50	40	250
Myrtaceae	*Leptospermum laevigatum*	Coast Teatree			1	3								
Myrtaceae	*Leptospermum polygalifolium* subsp. *cismontanum*	Tantoon												
Myrtaceae	*Leptospermum trinervium*	Flaky-barked Tea-tree												
Myrtaceae	*Melaleuca decora*													
Myrtaceae	*Melaleuca ericifolia*	Swamp Paperbark												
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark												
Myrtaceae	*Melaleuca nodosa*	Prickly- leaved Paperbark												
Myrtaceae	*Melaleuca quinquenervia*	Broad-leaved Paperbark	25	11			5	20			3	10	2	10
Myrtaceae	*Melaleuca sieberi*													
Myrtaceae	*Melaleuca thymifolia*	Thyme Honey- myrtle												
Myrtaceae	*Micromyrtus ciliata*	Heath- myrtle												
Orchidaceae	*Acianthus fornicatus*	Pixie Caps												
Orchidaceae	*Chiloglottis sp.*													
Orchidaceae	*Pterostylis longifolia*	Tall Greenhood												
Orchidaceae	*Pterostylis mutica*	Midget Greenhood												
Phormiaceae	*Dianella caerulea*	Blue Flax-lily	2	20										
Phormiaceae	*Dianella longifolia*													
Phyllanthaceae	*Billardiera scandens*	Hairy Apple Berry												
Picrodendraceae	*Pseudanthus orientalis*													
Pinaceae	**Pinus elliottii*	Slash Pine												
Pinaceae	**Pinus radiata*	Radiata Pine					1	1						
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	1	1										
Poaceae	**Andropogon virginicus*	Whisky Grass	1	10										
Poaceae	**Axonopus fissifolius*	Narrow-leafed Carpet Grass	1	25										
Poaceae	**Ehrharta erecta*	Panic Veldtgrass												
Poaceae	**Eragrostis cilianensis*	Stinkgrass												
Poaceae	**Eragrostis curvula*	African Love Grass	1	10	25	160								
Poaceae	**Melinis repens*	Red Natal Grass	1	5	10	50								
Poaceae	**Paspalum dilatatum*	Paspalum	1	1			1	1						
Poaceae	**Pennisetum clandestinum*	Kikuyu Grass	1	2										
Poaceae	**Setaria parviflora*		1	20										
Poaceae	**Setaria pumila*	Pale Pigeon Grass	1	25										
Poaceae	**Setaria sphacelata*	South African Pigeon Grass	1	15										
Poaceae	*Anisopogon avenaceus*	Oat Speargrass							1	5				
Poaceae	*Austrostipa pubescens*													
Poaceae	*Cynodon dactylon*	Couch	1	10			95	500						
Poaceae	*Echinopogon caespitosus*	Bushy Hedgehog Grass	1	30										
Poaceae	*Entolasia marginata*	Bordered Panic	2	30										
Poaceae	*Entolasia stricta*	Wiry Panic	1	10					1	20	1	50	5	500
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	1	30	1	20								
Poaceae	*Hemarthria uncinata* var. *uncinata*	Mat Grass									1	20	5	500
Poaceae	*Imperata cylindrica*	Blady Grass	1	5										
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Grass	1	60										
Poaceae	*Panicum simile*	Two-colour Panic												

Offset Site

Quadrat Number			Q40		Q41		Q42		Q43		Q44		Q45	
Vegetation Code			HU938		HU938		HU938		HU948		HU948		HU948	
Condition/ Zone			Regen		Regen		Regen		Mod-Good		Mod-Good		Mod-Good	
Easting			389219		389180		389105		388248		388523		388566	
Northing			6369229		6369104		6368731		6369086		6369144		6369226	
Family	**Scientific Name**	**Common Name**	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab	FPC	Ab
Poaceae	*Paspalidium distans*													
Poaceae	*Paspalidium sp.*		1	10										
Poaceae	*Themeda triandra*	Kangaroo Grass	1	20										
Polygalaceae	*Comesperma ericinum*	Pyramid Flower												
Polygonaceae	*Persicaria decipiens*	Slender Knotweed					1	1						
Proteaceae	*Banksia aemula*	Wallum Banksia												
Proteaceae	*Banksia oblongifolia*													
Proteaceae	*Banksia serrata*	Old Man Banksia			1	1								
Proteaceae	*Conospermum taxifolium*	Variable Smoke-bush												
Proteaceae	*Hakea sericea*	Needlebush												
Proteaceae	*Hakea teretifolia*	Needlebush											1	5
Proteaceae	*Isopogon anemonifolius*	Broad- leaf Drumsticks												
Proteaceae	*Lambertia formosa*	Mountain Devils												
Proteaceae	*Persoonia lanceolata*	Lance Leaf Geebung			2	40								
Proteaceae	*Persoonia levis*	Broad-leaved Geebung												
Proteaceae	*Petrophile pulchella*	Drumsticks												
Pteridaceae	*Cheilanthes sieberi*													
Restionaceae	*Baloskion pallens*													
Restionaceae	*Baloskion sp.*													
Restionaceae	*Baloskion tetraphyllum* subsp. *meiostachyum*	Plume Rush	5	20										
Restionaceae	*Empodisma minus*	Spreading Rope- rush							20	250				
Restionaceae	*Eurychorda complanata*													
Restionaceae	*Hypolaena fastigiata*													
Restionaceae	*Leptocarpus tenax*								1	5				
Restionaceae	*Lepyrodia muelleri*								3	50				
Restionaceae	*Lepyrodia scariosa*								1	10				
Rubiaceae	**Richardia brasiliensis*	White Eye												
Rubiaceae	*Pomax umbellata*		1	2										
Rutaceae	*Eriostemon australasius*	Pink Wax Flower												
Rutaceae	*Zieria laxiflora*	Wallum Zieria												
Selaginellaceae	*Selaginella uliginosa*	Swamp Selaginella												
Solanaceae	**Solanum pseudocapsicum*	Jerusalem Cherry	1	1	1	2								
Stylidiaceae	*Stylidium graminifolium*	Grass Trigger Plant												
Thymelaeaceae	*Pimelea linifolia subsp. linifolia*	Slender Rice-flower												
Verbenaceae	**Lantana camara*	Lantana	1	3										
Verbenaceae	**Verbena bonariensis*	Purpletop	1	1										
Violaceae	*Viola hederacea*	Ivy-leaved Violet	1	15										
Xanthorrhoeaceae	*Xanthorrhoea glauca*													
Xanthorrhoeaceae	*Xanthorrhoea minor*													
Xyridaceae	*Xyris gracilis*								1	20				
Zamiaceae	*Macrozamia communis*	Burrawang												
		Total Species Richness	**50**		**17**		**8**		**21**		**10**		**17**	

* Denotes Introducted Species

# Denotes Threatened Species (Listed under TSC Act and/ or EPBC)

APPENDIX 3. DEVELOPMENT SITE CREDIT REPORT

Biodiversity credit report

This report identifies the number and type of biodiversity credits required for a major project.

Date of report: 12/10/2016 Time: 1:52:35PM Calculator version: v4.0

Major Project details

Proposal ID:	167/2016/3878MP
Proposal name:	Cabbage Tree Road Sand Quarry
Proposal address:	Cabbage Tree Road Williamtown NSW 2318
Proponent name:	The Trustee for WSS Unit Trust
Proponent address:	PO Box 898 Newcastle NSW 2300
Proponent phone:	0429 875 355
Assessor name:	Samara Schulz
Assessor address:	64 Medcalf Street Warners Bay NSW 2282
Assessor phone:	02 4949 5200
Assessor accreditation:	167

Summary of ecosystem credits required

Plant Community type	Area (ha)	Credits created
Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	40.37	2,207.07
Total	40.37	2,207

Credit profiles

1. Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast, (HU860)

Number of ecosystem credits created 2,207

IBRA sub-region Karuah Manning

Offset options - Plant Community types	Offset options - IBRA sub-regions
Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast, (HU860) Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast, (HU832) Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands, (HU851) Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula, (HU862)	Karuah Manning 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
Eucalyptus parramattensis subsp. decadens	Eucalyptus parramattensis subsp. decadens	230.00	3,220
Koala	Phascolarctos cinereus	40.38	1,050
Wallum Froglet	Crinia tinnula	0.71	9
Eastern Osprey	Pandion cristatus	40.38	525
Camfields Stringybark	Eucalyptus camfieldii	227.00	17,479

APPENDIX 4. BIOBANK SITE CREDIT REPORT

BioBanking credit report

This report identifies the number and type of credits required at a BIOBANK SITE

Date of report: 13/10/2016 Time: 8:03:35PM Calculator version: v4.0

Biobank details

Proposal ID:	167/2016/3892B
Proposal name:	Cabbage Tree Road Offset Area
Proposal address:	Cabbage Tree Road Williamtown NSW 2318
Proponent name:	Port Stephens Council
Proponent address:	116 Adelaide Street Raymond Terrace NSW 2324
Proponent phone:	02 4949 5200
Assessor name:	Samara Schulz
Assessor address:	64 Medcalf Street Warners Bay NSW 2282
Assessor phone:	02 4949 5200
Assessor accreditation:	167

Additional information required for approval:

- ☐ Use of local benchmark
- ☐ Expert report...
- ☐ Request for additional gain in site value

Ecosystem credits summary

Plant Community type	Area (ha)	Credits created
Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast	40.13	388.00
Parramatta red gum - Fern-leaved banksia - Melaleuca sieberi swamp woodland of the Tomaree Peninsula	3.75	22.00
Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands	29.91	311.00
Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	30.98	273.00
Wallum Banksia-Monotoca scoparia heath on coastal sands of the Central Coast and lower North Coast	10.26	80.00
Wallum Bottlebrush - Leptocarpus tenax - Baloskion pallens Wallum sedge heath of the lower North Coast	15.10	115.00
Total	130.13	1,189

Credit profiles

1. Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands, (HU851)

Number of ecosystem credits created	311
IBRA sub-region	Karuah Manning

2. Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast, (HU860)

Number of ecosystem credits created	273
IBRA sub-region	Karuah Manning

3. Wallum Banksia-Monotoca scoparia heath on coastal sands of the Central Coast and lower North Coast, (HU917)

Number of ecosystem credits created	80
IBRA sub-region	Karuah Manning

4. Wallum Bottlebrush - Leptocarpus tenax - Baloskion pallens Wallum sedge heath of the lower North Coast, (HU948)

Number of ecosystem credits created	115
IBRA sub-region	Karuah Manning

5. Parramatta red gum - Fern-leaved banksia - Melaleuca sieberi swamp woodland of the Tomaree Peninsula, (HU865)

Number of ecosystem credits created	22
IBRA sub-region	Karuah Manning

6. Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast, (HU938)

Number of ecosystem credits created	388
IBRA sub-region	Karuah Manning

Species credits summary

Common name	Scientific name	Extent of impact Ha or individuals	Number of species credits created
Eucalyptus parramattensis subsp. decadens	Eucalyptus parramattensis subsp. decadens	634.00	4,501
Small-flower Grevillea	Grevillea parviflora subsp. parviflora	102.00	724
Eastern Osprey	Pandion cristatus	101.02	717
Koala	Phascolarctos cinereus	104.78	744
Wallum Froglet	Crinia tinnula	85.39	606
Camfields Stringybark	Eucalyptus camfieldii	1,641.00	11,651

Additional management actions

Additional management actions are required for:

Vegetation type or threatened species	Management action details
Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast	Exclude commercial apiaries
Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast	Exclude miscellaneous feral species
Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast	Feral and/or over-abundant native herbivore control
Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast	Fox control
Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast	Slashing
Camfields Stringybark	Feral and/or over-abundant native herbivore control
Eastern Osprey	Maintain or re-introduce natural flow regimes
Eucalyptus parramattensis subsp. decadens	Feral and/or over-abundant native herbivore control
Eucalyptus parramattensis subsp. decadens	Slashing
Koala	Exclude miscellaneous feral species
Koala	Slashing
Parramatta red gum - Fern-leaved banksia - Melaleuca sieberi swamp woodland of the Tomaree Peninsula	Exclude commercial apiaries
Parramatta red gum - Fern-leaved banksia - Melaleuca sieberi swamp woodland of the Tomaree Peninsula	Exclude miscellaneous feral species
Parramatta red gum - Fern-leaved banksia - Melaleuca sieberi swamp woodland of the Tomaree Peninsula	Feral and/or over-abundant native herbivore control

Parramatta red gum - Fern-leaved banksia - Melaleuca sieberi swamp woodland of the Tomaree Peninsula	Fox control
Parramatta red gum - Fern-leaved banksia - Melaleuca sieberi swamp woodland of the Tomaree Peninsula	Slashing
Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands	Exclude commercial apiaries
Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands	Exclude miscellaneous feral species
Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands	Feral and/or over-abundant native herbivore control
Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands	Fox control
Scribbly gum - Wallum Banksia - Prickly-leaved Paperbark heathy coastal woodland on coastal lowlands	Slashing
Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	Exclude commercial apiaries
Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	Exclude miscellaneous feral species
Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	Feral and/or over-abundant native herbivore control
Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	Fox control
Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast	Slashing
Wallum Banksia-Monotoca scoparia heath on coastal sands of the Central Coast and lower North Coast	Control of feral pigs
Wallum Banksia-Monotoca scoparia heath on coastal sands of the Central Coast and lower North Coast	Feral and/or over-abundant native herbivore control
Wallum Banksia-Monotoca scoparia heath on coastal sands of the Central Coast and lower North Coast	Fox control
Wallum Banksia-Monotoca scoparia heath on coastal sands of the Central Coast and lower North Coast	Slashing
Wallum Bottlebrush - Leptocarpus tenax - Baloskion pallens Wallum sedge heath of the lower North Coast	Control of feral pigs
Wallum Bottlebrush - Leptocarpus tenax - Baloskion pallens Wallum sedge heath of the lower North Coast	Feral and/or over-abundant native herbivore control
Wallum Bottlebrush - Leptocarpus tenax - Baloskion pallens Wallum sedge heath of the lower North Coast	Fox control
Wallum Bottlebrush - Leptocarpus tenax - Baloskion pallens Wallum sedge heath of the lower North Coast	Slashing
Wallum Froglet	Control exotic pest fish species (within dams)
Wallum Froglet	Maintain or re-introduce natural flow regimes
Wallum Froglet	Slashing

APPENDIX 5. STAFF MEMBERS

The qualifications, title, and contribution of each staff member involved in this assessment are outlined in the following table.

Name	Qualification	Title/Experience	Contribution
Aaron Mulcahy	BEnv Sc & Mgt MScStud (Botany) Accredited Biobanking Assessor (no. 172)	Senior Ecologist	Vegetation surveys
Adam Blundell	BSc (Hons) Accredited Biobanking Assessor (no. 006)	Principal Ecologist	Report review
Dan Pedersen	BSCEngTech GIFireE, BDAP-A	Senior Ecologist / Bushfire	Vegetation surveys
Gayle Joyce	BSc (Forestry) (Hons)	GIS Specialist	GIS and figure preparation
Samara Schulz	BEnv Sc & Mgt (Hons) Accredited Biobanking Assessor (no. 167)	Ecologist	Vegetation surveys, credit calculations and report preparation.