SALT ASH SAND QUARRY AND TOMALLA OFFSET BIOBANK ASSESSMENT REPORT

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For:
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May 2011

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Environmental Planning, Assessment and Management

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Introduction

1.1 Background

ATB Morton has approval to clear 28 hectares of vegetation to enable the development of a sand quarry at Salt Ash, NSW. Since it became apparent that an offset site would be required to facilitate the Part 3A sand extraction approval at Salt Ash, ATB Morton Pty Ltd has been actively looking to identify potential offset sites in the Port Stephens LGA and in particular the Tilligery and Tomaree Peninsulas. Between 2007 and 2009, ATB Morton Pty Ltd undertook a range of measures in an attempt to secure an offset site, including regularly reviewing available real estate and actively pursuing landholders with sites supporting dune forest vegetation similar to that recorded on the proposed sand extraction site.

During the conduct of the searches it became apparent that such holdings do not regularly become available for purchase and that the far majority of suitable offset sites with the required criteria (similar dune vegetation and large size) are not in private ownership (non Aboriginal freehold) but are held by various government agencies (DECCW, Port Stephens Council, Energy Australia, Hunter Water Corporation, RTA, Commonwealth and Crown lands) for a range of strategic purposes. To illustrate this point, some of the key land tenure data layers for publicly held lands were overlayed onto the LHCCREMS updated extant vegetation community map for the Port Stephens LGA (House 2003). The overlay shows (visually) that the Coastal Apple-Blackbutt Sands vegetation map unit (MU33) has the majority of its occurrence on public lands in the LGA (DECCW, Forests NSW, Commonwealth and Hunter Water Corporation) with few MU33 polygons on (non Aboriginal) freehold lands. As a result, the likelihood of securing a suitable freehold site in the LGA with the appropriate ecological and size criteria was determined to be low. This figure is provided as **Appendix A.**

ATB Morton Pty Ltd did, however, identify Worimi Local Aboriginal Land Council as having local freehold land supporting dunal vegetation suitable for offsetting purposes and hence commenced negotiations with the LALC in October 2008. Negotiations included ongoing discussions with the LALC CEO Andrew Smith and preliminary investigations on LALC land undertaken by Orogen. Negotiations were ultimately unsuccessful as the Worimi LALC advised that they are unable to enter into agreements which might place restrictions over their holdings in perpetuity.

Given the difficulty in sourcing freehold landholdings with suitable dunal vegetation, ATB Morton Pty Ltd, in consultation with the DECCW, commenced investigation options to secure a landholding on the NSW North Coast coastal ranges at Markwell, near Bulahdelah. The 389 hectare Markwell site was identified as a potential offset site given its size, habitat (entirely forested) and connectivity with NSW State Forest and DECC Estate.

ATB Morton Pty Ltd has received approval for a Part 3A Sand Quarry development on Lot 4042 DP 1090633, Lots 632 and 633 DP 609506, Nelson Bay Road, Salt Ash, NSW. The existing approval requires ATB Morton to offset the biodiversity impacts associated with the development through securing and managing (for conservation) 120 hectares of vacant bushland at Markwell, west of Bulahdelah, NSW. The Markwell site was endorsed as suitable offset lands by the NSW Department of Planning for the Part 3A Project.

The Markwell property is no longer able to be secured by ATB Morton and consequently alternative offset lands would be required as part of the Salt Ash Sand Quarry Project Approval. After a process of identifying alternative offset sites, a site described as Lot 2 DP 707938 situated on the Tomalla Plateau, west of Gloucester, was ultimately chosen (and secured) as a preferred offset alternative to the Markwell property.

1.2 OEH Interim Policy Application

On 30 November 2010 the Director General of the Department of Climate Change and Water (now the Office of Environment and Heritage) approved an "*Interim policy on assessing and offsetting biodiversity impacts of Part 3A developments". The policy seeks to provide a consistent and transparent approach to impact assessment and offsetting for projects assessed under Part 3A of the EP&A Act. The policy also provides for aligning NSW and Commonwealth assessment and offsetting processes by providing an assessment pathway that is likely to satisfy both NSW and DSEWPC requirements provided certain requirements are met.*

The policy outlines a tiered approach to determining an appropriate outcome for offsetting of clearing for major project proposals. It is identified that a proposal can fall short of the "Improve or Maintain" standard in two ways with one of them being that the amount and type of offsetting secured is inconsistent with the requirements of the Biobanking Assessment Methodology (BBAM). In this circumstance a Tier 3: negotiating a "Mitigated Net Loss" outcome may be appropriate following consideration of the following factors:

a) Whether the credits required by the calculator are available on the market;

A search of the biobank credit register (Expression of Interest for biobank sites) revealed no Blackbutt-Apple dune forest vegetation available on the market.

b) Whether alternative offset sites (other than credits)are available on the market;

As discussed in Section 1.1 there are no alternative offset sites available on the market.

c) The overall costs of the offsets and whether these costs are reasonable given the circumstances.

Given that no credits or alternative sites are available this factor becomes irrelevant.

Attachment B of the policy outlines the variation criteria for mitigated net loss that may be applied to the BBAM where a Tier 3 approach is considered appropriate. Part a) of Attachment B allows the conversion of ecosystem credits for one vegetation type to any vegetation type within the same vegetation formation in the same IBRA region.

The Tomalla offset site satisfies part a) of the Attachment B of the policy.

1.3 Purpose of this Report

A Biobank Assessment was carried out on the Tomalla offset site by Orogen to determine the type and number of Ecosystem and Threatened Species credits that the offset site generates (as a biobank site). Results of this assessment could then be compared with those of the Biobank Assessment of the development site that was carried out by Orogen in 2009 (and re-run in 2011).

This purpose of this report is to present the methods and results of a Biobank Assessment undertaken by Orogen on the Salt Ash (development) and Tomalla (offset) sites.

1.4 Structure of Report

Section 2.0 – summarises the environmental settings of the development and offset sites, including topography, drainage, geology and soils and surrounding land use.

Section 3.0 – details the biobank assessment methodologies for the development and offset sites, including field surveys, landscape circle assessments, vegetation zone mapping and determination of biobank vegetation types as well as justification of management zone attribute scores.

Section 4.0 – presents the Credit Calculator (v1.2) landscape and site scores as well as Ecosystem and Threatened Species credit profiles.

Section 5.0 – Provides a comparison of biobank results between the development and offset sites using the offset rules prescribed in the DECCW (2010) Interim Offsetting Policy for Part 3A proposals.

Section 6.0 – Outlines the necessary future management measures for the Biobank Site.

Existing Environment

2.1 Salt Ash Development Site

2.1.1 Site Location

The Salt Ash development site is located on the southern side of Nelson Bay Road at Salt Ash within the Port Stephens Local Government Area. The site occurs within the NSW North Coast IBRA Bioregion and the North Coast Botanical Subdivision of NSW.

Portions of the site adjoin the Worimi National Park.

The site lies within the Hunter-Central Rivers Catchment Management Authority (CMA), Karuah-Manning CMA sub-region and the Sydney-Newcastle Barriers and Beaches Mitchell Landscape.

A site locality plan for the Salt Ash development site is provided as **Figure 2.1.**

2.1.2 Topography and Drainage

The site is located within the coastal back dune topography associated with Stockton Beach. The surrounding landform is typified by moderately undulating to steep sand dune topography with relief of RL 30m in the middle of the extraction area to RL 2 m in the northern part of the site (outside extraction footprint).

Drainage from the extraction footprint area is to groundwater via direct dune infiltration.

2.1.3 Geology and Soils

The quarry extraction footprint is mapped as having the Boyces Track and Hawks Nest Soil Landscape Units comprising steep to gently undulating, stable Holocene dunes on the Tomago Coastal Plain between North Stockton to Bobs Farm (Matthei 1995).

Regional subsurface geology in the vicinity of the site is underlain by an outer barrier sand deposit described as the Stockton Sand Member. This unit was formed approximately 3000 to 6500 years ago. The sand is typified by clean, permeable, fine to coarse quartzose sand 10m to 40m thick.

2.2 Tomalla Offset Site

2.2.1 Site Location

The Tomalla offset site is situated on the Tomalla Plateau approximately 40 km to the north-west from the township of Barrington within the Gloucester Shire Council Local Government Area. The site occurs within the NSW North Coast IBRA Bioregion and the Northern Tableland Botanical Subdivision of NSW. The site lies within the Tomalla sub-region of the Hunter-Central Rivers CMA .

The site adjoins Barrington Tops State Forest to the south and west which is presumed to be managed for logging purposes.

A Tomalla offset site locality plan is provided as **Figure 2.2.**

2.2.2 Topography and Drainage

The site forms part of the heavily dissected Kangaroo Range on the Tomalla/Barrington Tops Plateau within the upper Manning River catchment and is characterised by the deeply incised perennial watercourses Pigna Barney River and Tomalla Creek (and their tributaries) at mid plateau elevations of 600-700 m AHD. Relief is moderate to high as the perennial watercourses drain steep sided skeletal hillslopes that reach maximum elevations around 900 -1000m AHD. One prominent ridge is evident in the central portion of the site which separates the two perennial watercourses and extends offsite to the south-west.

There are two drainage sub-catchments on the site, these being:

- All areas on the site south of the central ridgeline drain to Tomalla Creek; and
- Al areas on the site north of the central ridgeline drain to Pigna Barney River.

2.2.3 Geology

The geology of the site is complex, essentially comprising three main units, with increasing age across the site and downslope from south to north. Geological descriptions are based on the Tamworth 1:250000 Geological Series Sheet SH56-13 (NSW Dept. Mines, 1971).

The southern and western sections of the site are underlain by the Tertiary-age Liverpool Range Beds, comprising basalt, dolerite, polymictic conglomerate, quartzose sandstone, shale and bole. The central northern section of the site is characterised by a northwest-southeast aligned fault that separates two distinct older geological units.

The mid slopes draining to the north on the southern side of the fault are underlain by the Middle to Lower Devonian-age Tamworth Group comprising cherty argillite, arenite, greywacke and conglomerate, with isolated outcrops of limestone.

North of the fault, on the lower slopes, the site is underlain by the Devonian to Ordovician-age Wooloomin Beds comprising tuff, jasper, slate, limestone, conglomerate, chert, spilite and keratophyre. Either side of the fault are small isolated outcrops of the Lower Permian-age Serpentinite.

2.2.4 Soils

Observations of soils across the site, based on surficial inspections and observations of soil profiles exposed by road cuttings and tributary incisions, indicate that the upper slopes are characterised by clay soils with uniform profile and very little quartz sand content, most likely representative of the Euchrozem/Krasnozem soil groups.

The mid slopes are characterised by soils with greater textural contrast through the profile, comprising Red Earths and Red/Yellow Podzolics.

Soils on the lower slopes were more variable, though in general can be described as having mild textural contrast throughout the profile, being predominantly clay with minimal sand content. These soils are most likely representative of Krasnozem and Red/Yellow Podzolic soil groups.

Salt Ash Biobank Assessment

3.1 Salt Ash Development Site

3.1.1 Landscape Value

Landscape Assessment Circles (Percentage Native Vegetation Cover)

100 and 1000 hectare landscape assessment circles were centered over the development site using AutoCAD (version 10) and Google Earth Pro imagery to calculate the percentage native vegetation cover within each circle. Percent native vegetation cover calculations were made for before and after development based on the quarry extraction footprint area of 25.8 hectares. Polygons were drawn around areas devoid of native vegetation (using AutoCAD) within each assessment circle to calculate total 'cleared' areas. Total 'cleared' areas were then subtracted from the respective 100 and 1000 hectare areas to obtain extant native vegetation cover which was then converted to percentage native vegetation cover. Percentage native vegetation cover values were then used to determine vegetation cover classes before and after development for the two assessment circles.

The assessment circles and the individual polygon areas for the two assessment circles used to calculate 'total areas cleared' are shown in **Figure 3.1**.

Background calculations for the percentage native vegetation cover and vegetation cover classes are provided in **Table 3.1** shown below.

Table 3.1 - Percentage Native Vegetation Cover and Vegetation Cover Class

	Total area cleared (ha)	Extant native vegetation before development (ha)	Extant native vegetation after development (ha)	% Native Vegetation Cover (before development)	% Native Vegetation Cover (after development)	Native Vegetation Cover Class (before development)	Native Vegetation Cover Class (after development)
100ha circle	18.3	81.7	55.9	81.7	55.9	81-90	51-60
1000ha circle	321.4	678.6	652.8	67.8	65.2	61-70	61-70

Results from the vegetation cover class values shown above indicate that no change in vegetation cover class for the 1000ha assessment circle resulted from the development. The development, did however, result in a 'crossing' or 'downgrading' of 3 vegetation cover classes for the 100ha assessment circle. Changes in vegetation cover classes impact on the overall Landscape Value Score for the site.

Connectivity Width

To determine the existing Linkage Width Class of the Salt Ash site, it was first necessary to determine the narrowest (most limiting) link that connects site vegetation to adjoining vegetation. This link was identified along the site's western boundary as having a width of 1900 metres which equates to an existing Linkage Width Class of >500m (the highest class).

It was then necessary to assess whether, as a result of the development, there was likely to be a change in the existing Linkage Width Class. In other words, would the removal of site vegetation associated with the development site lead to a reduced linkage width with a correspondingly lower Linkage Width Class.

The primary link to connecting vegetation and fauna habitat from the site is to the south-east and south-west to the Holocene dune forests associated with the Stockton Sandbeds which occur from Anna Bay south-west to Fern Bay. Linkage widths before and after development were calculated using Google Earth Pro imagery and Google Earth's ruler tool functions and were based on the limiting widths available. Linkage width calculations were then used to determine linkage width classes in the Credit Calculator for before and after development scenarios.

Linkage width calculations are provided in **Table 3.2** shown below.

Table 3.2 - Linkage Width Classes

	Linkage Width (m)	Linkage Width Class (m)
Before Development	1900	>500
After Development	1000	>500

Results from **Table 3.2** show that whilst the development will result in a reduced linkage width, the sand quarry will not result in a change to the linkage width class as the primary link will remain greater than 500 metres wide after development.

Primary link vegetation and primary linkage widths (before and after development) are shown in **Figure 3.2**.

Connectivity Condition

Google Earth Pro imagery was used to determine condition of the primary link vegetation, this being the Apple-Blackbutt Coastal Dune Forest adjoining the site to the southeast and southwest. The primary link vegetation was determined to be 'undisturbed' (part of Worimi NP) and therefore at benchmark value for overstorey and groundcover Projected Foliage Cover (PFC) for both before and after development.

The sand quarry will result in a post development 1km wide band of undisturbed primary linking vegetation which is not expected to hinder or impact upon local wildlife movements on the Stockton Sandbed forests to a significant extent, based on reported minimum linkage width thresholds for a range of terrestrial and scansorial fauna. As a result, there is no change in Connectivity Condition values before and after development (both remain at benchmark for overstorey and groundcover).

Threatened Species Sub Zones

Threatened species sub zones (TSSZ) are analogous to vegetation types and as such, the Salt Ash development site supports a single TSSZ, this being 25.8 hectares of Coastal Blackbutt-Apple Dune Forest within the extraction footprint. The distribution of this TSSZ on the Salt Ash development site is shown in Figure 3.3.

A small area of Swamp Mahogany-Paperbark Swamp Sclerophyll Forest was recorded in a dune swale fringing the northern powerline easement straddling the middle and western lot boundary. This vegetation type was mapped as having an area less than the minimum TSSZ threshold size of 0.25 hectares and thus was not included as a separate TSSZ in the Salt Ash biobank assessment (it was incorporated into the Blackbutt-Apple Dune Forest TSSZ).

Adjacent Remnant Vegetation Area

Adjacent Remnant Vegetation Area (ARVA) is defined as the area of Moderate/Good vegetation on, and adjoining, the development site. Google Earth pro imagery and the polyline feature in AutoCAD was used to map the ARVA for the development site.

ARVA Calculations are shown in Table 3.3 below.

Table 3.3 - Adjacent Remnant Vegetation Area

	Development Site Mod/Good Condition Vegetation	Mod/Good Condition Vegetation adjoining development site (eg. Worimi NP, other freehold land)	ARVA size class (ha)	Adjacent Remnant Vegetation Area	Patch Size (ARVA plus low condition vegetation)
Area (ha)	25.8	2000	>500	501	501

Based on the results shown above, the ARVA mapped for the development site surpassed the 500 hectare threshold (size class) giving the site an ARVA value of 501. No further ARVA mapping was thus undertaken beyond the 500 hectare threshold.

ARVA mapping for the development site is shown in **Figure 3.4**.

Patch Size

Patch Size is defined as ARVA plus low condition vegetation on and/or adjoining the development site. There is not considered to be any low condition vegetation on or adjoining the development site up to the 500 hectare threshold and thus patch size was calculated to be the same as the ARVA value, this being 501.

The Patch Size for the development site is also shown in **Figure 3.4.**

Vegetation Type and Formation

The Salt Ash TSSZ Dune Forest supports a canopy dominated by Coastal Blackbutt (*Eucalyptus pilularis*) and Smooth barked Apple (*Angophora costata*), a mid stratum dominated by *Banksia serrata, Monotoca elliptica, Leucopogon lanceolatus var gracilis, Persoonia levis, Acacia ulicifolia, Acacia longifolia subsp. longifolia, Bossiaea rhombifolia subsp rhombifolia* and *Acacia suaveolens* and a groundcover dominated by native grasses, forbs, graminoids, cycads, low shrubs and climbers including *Themeda australis, Tetratheca thymifolia, Ricinocarpus pinifolius, Platyscace lanceolata, Gonocarpus teucrioides, Macrozamia communis, Lomandra longifolia ssp longifolia, Dianella caerulea, Hibbertia obtusifolia, Dillwynia glaberrima, Pteridium esculentum, Parsonsia straminea, Hardenbergia violacea*.

This vegetation type is well represented on the larger coastal sand masses of the NSW North Coast Bioregion and has an equivalent Biobank Vegetation Type (BVT) HU509, this being 'Blackbutt-Smooth barked Apple shrubby open forest on coastal sands of the southern North Coast'. The BVT is considered to be a 'good fit' for the Blackbutt-Apple Dune Forest TSSZ at Salt Ash.

The TSSZ was considered to have a 'Moderate/Good' Condition Class as it did not meet the criteria for 'Low Condition' and generally had benchmark PFC values for overstorey and groundcover.

No 'ancillary code' was given to the TSSZ as the vegetation type was generally homogenous within the quarry extraction footprint (eg. weeds were minimal and evenly distributed).

Data for percentage Native Vegetation Cover, Connectivity and TSSZ combined to give the development site a Landscape Score of 14 (compared with a Landscape Score of 17 in Credit Calculator Version 1.1).

3.1.2 Geographic and Habitat Features

Step 2 in the Credit Calculator asks whether the development site impacts upon certain Geographic and Habitat Features (GHFs). Of the 16 GHFs listed, the development site was deemed to impact upon the following three:

1. Coastal sands;
2. Deep, low nutrient sands; and
3. Eucalypt forest.

The development site was not deemed to impact upon the remaining 13 listed GHFs, these being:

- Hollow bearing trees within 200m of riparian zone;
- Land containing caves;
- Land containing escarpments, cliffs;
- Land within 1km of rocky outcrops, clifflines;
- Land within 100m of semi-permanent ponds and depressions containing leaf litter;
- Land within 40 m of waterbody (creeks, rivers, lakes, lagoons);
- Land within 40m of rainforest, scrub, riparian or estuarine communities;
- Sheltered areas such as gullies and southerly slopes in tall open forest on well drained gravelly soil at elevations of 10-200 metres;
- Land north of Bulahdelah;
- Land north of Gloucester;

- Land within 25km of Forster;
- Land within 5km of Wallaroo NR in Upper Hunter CMA subregion; and
- Land within 10km radius of Kurri Kurri.

3.1.3 Identified Populations

There are no Identified Populations relevant to the Salt Ash sand extraction development.

3.2 Threatened Species 'Species Credits'

Step 4 of the Credit Calculator (CC) requires the proponent to undertake a Site Survey targeting a total of 16 Threatened species and populations predicted by the CC's Threatened Species filter as possible site occurrences (that is, only for those species where 'Species Credits' apply). The proponent has an option, however, not to undertake a Site Survey and either assume one or more of the listed Threatened species occur on the site or prepare an Expert Report discounting their presence based on sound biological/ecological reasoning.

A discussion of each of the listed 'Species Credit' Threatened species relevance to the development site is provided below.

3.2.1 Threatened Flora

Callistemon linearifolius

This species is known to occur locally in Karuah NR in both *Eucalyptus pilularis/E.globoidea/E.fibrosa* DSF on Carboniferous sediments as well and in *E.resinifera/Angophora inopina* Swamp Forest within Wallaroo Swamp (I Mamott pers. obs.). The species has also been reported in *E.robusta/Melaleuca quinquenervia* Swamp Forest at Soldiers Point on Nerong Volcanics (Okada 2006) although the specific habitat of this population requires verification.

This species is not known from dry dune forest habitats and is thus not considered to be a possible site occurrence. This is consistent with the fact that the species was not recorded in ecological investigations on the site carried out by EcoHub (2007) and Orogen (2009).

Cryptostylis hunteriana

This orchid species has been recorded locally (Port Stephens) in a number of vegetation types strongly associated with Nerong Volcanic peaks at Tomaree Head, Lemon Tree Passage water reservoirs and Gan Gan Gill (I Mamott, pers. obs.).

The species is not known from dry dune forest habitats and is not considered to be a likely site occurrence at Salt Ash. Targeted surveys undertaken by Orogen (2011) failed to record this species on the site.

Diuris arenaria

This species is known to occur locally within the new Energy Australia easement running from Fern Bay to Nelson Bay and along Hunter Water borelines in derived low dune shrubland habitats (I Mamott, pers. obs.).

The species has been recorded within the 'old' northern EA easement on the development site by Orogen (2009) as part of targeted surveys for this species. The proposal has been altered to exclude the orchid population from sand extraction and a vegetation buffer proposed to assist in its protection.

Diuris praecox

This species is known to occur locally within the new Energy Australia easement running from Fern Bay to Nelson Bay and along Hunter Water borelines in derived low dune shrubland habitats (I Mamott, pers. obs.).

Whilst no targeted surveys for the species was undertaken on the site, suitable derived dune shrubland habitats for this species has similarly be excluded from the sand extraction footprint.

Eucalyptus camfieldii

This species has been recorded locally at Williamtown in coastal scrub-heath with dense stands of *Melaleuca nodosa* (Bell 2006; I Mamott pers. obs.) and was considered as a possible site occurrence in dry dune forest habitats at Salt Ash.

The species has not been recorded during the site's ecological investigations as part of the Part 3A project EA (Orogen 2009; EcoHub 2006).

Melaleuca groveana

This species has been recorded locally at Fame (Cove) Mountain, Tomaree Head and other sites strongly associated with Nerong Volcanic peaks in Nerong Open Forest and Nerong scrub (I Mamott pers. obs). The species is not known from dry dune forest habitats and is not considered a possible site occurrence at Salt Ash.

This is consistent with the fact that the species has not been recorded on the Salt Ash development site during the EA's ecological investigations (Orogen 2006; EcoHub 2006).

Prostanthera densa

This species is strongly associated with the Nerong Volcanic peaks on the Tomaree peninsula, with populations recorded at South Gan Gan, Glovers and Kurrara Hills (Bell 2006; I Mamott pers. obs.). The species is not known from dry dune forest habitats in the locality and is not considered a likely site occurrence at Salt Ash.

This is consistent with the fact that the species has not been recorded on the Salt Ash development site during the EA's ecological investigations (Orogen 2006; EcoHub 2006).

Rhizanthella slateri

This orchid species has not been recorded in the Port Stephens LGA. The species has been recorded on Volcanics at the base of Alum Mountain at Bulahdelah. The species is not known from dry dune forest habitats and is not considered a likely site occurrence at Salt Ash.

No targeted surveys have been undertaken for the species on the Salt Ash site.

Tetratheca juncea

This species has been recorded in Karuah NR in *Corymbia gummifera/Angophora costata/E.umbra* DSF on Carboniferous bedrock, at Fame Mountain on Nerong Volcanics and at Salt Ash Weapons Range in Coastal Clay Forest (I Mamott pers. obs.). The species is not known from dry dune forest habitats and is not considered a likely site occurrence at the Salt Ash development site.

This is consistent with the fact that the species has not been recorded on the Salt Ash development site during the EA's ecological investigations (Orogen 2006; EcoHub 2006).

3.2.2 Threatened fauna

The following 'Species Credits' Threatened fauna species and populations are considered as possible occurrences on the Salt Ash development site based on site habitats and their life cycle requirements although none were recorded by EcoHub (2006) during its ecological surveys for the Part 3A project:

- Gang gang Cockatoo (*Callocephalon fimbriatum*);
- Emu (Dromaius novaehollandiae) Endangered Population (North Coast);
- Little Eagle (Hieraaetus morphnoides);
- Square tailed Kite (Lophoictinia isura);
- Brush tailed Phascogale (Phascogale tapoatafa);
- Eastern Chestnut Mouse (Pseudomys gracilicaudatus).

The Endangered Population of the Koala (*Phascolarctos cinereus*) at Tea Gardens and Hawks Nest is not considered as a likely occurrence at Salt Ash and was not recorded by EcoHub (2006) in its ecological investigations for the Part 3A Project. Habitats for the Koala on the Salt Ash site are considered to be marginal at best.

3.3 Survey Results

3.3.1 Vegetation Plot/Transect Data

A total of four (4) biobank plots/transects (minimum required) were undertaken within the sand extraction footprint area on 28 April 2009 by Orogen ecologists Isaac Mamott and Will Steggall. Full floristics were recorded within 400m^2 quadrats whilst vegetation cover was recorded along 50 metre long transects running parallel to each quadrat. Native overstorey and mid storey cover were derived from tallying data from 10 points along each transect (every 5 metres) whilst groundcover was derived from tallying data from 50 points along each transect (every 1 metre).

Transect/plot data was entered into Step 5b of the CC for the Blackbutt-Apple DSF TSSZ for the site and is shown below in **Table 3.4**.

Table 3.4 - Plot/Transect Data

Plot No.	Plant Species Richness	Native Over Storey Cover	Native Mid Storey Cover	Native Ground Cover (grasses)	Native Ground Cover (shrubs)	Native ground cover (other)	Exotic Plant Cover	# Hollow Trees	Over Storey Regeneration	Length of Fallen Logs	AMG Grid Refs (WGS84)
1	19	24	26.5	4	12	58	0	1	0	2	400329; 6370921
2	24	31	8	4	24	46	0	2	0	10	400307; 6370496
3	25	51.5	3.5	16	14	54	0	3	0	5	400073; 6370694
4	22	36	20.5	2	4	40	0	2	0	7	400390; 6370998

3.3.2 Management Zones

Given the homogeneity of vegetation within the extraction footprint, a single management zone was entered into the CC. Post development management zone attribute scores (for vegetation cover, plant species richness, etc.) were reduced to '0'.

3.3.3 Threatened Species Survey Data

None of the 'Species Credits' Threatened species and populations were assessed as being impacted by the development and thus loss values for all species were input as '0'.

3.4 Credit Report

The Credit Calculator (v1.2) was 'run' with the data input as described in Sections 3.1-3.5 and generated a Credit Profile for the development site as shown below in **Table 3.5**.

Table 3.5 - Credit Profile – Blackbutt-Smooth barked Apple shrubby Forest on coastal sands of the southern North Coast (25.8 ha)

# Ecosystem Credits	Surrounding Vegetation Cover (%)	Patch Size (ha)	CMA Subregion	Offset Vegetation Types
1857	Minimum surrounding vegetation cover in which credits must be obtained = 30%	Minimum area of contiguous vegetation in which credits must be obtained = 100 ha	Karuah-Manning	1. Blackbutt-Smooth barked Apple shrubby Forest on coastal sands of the southern North Coast (HU509); 2. Red Bloodwood-scribbly Gum heathy Woodland on sandstone plateau of the Sydney Basin (HU595); 3. Smooth barked Apple-Sydney Peppermint-Turpentine heathy open forest on plateau areas of the southern Central Coast, Sydney Basin (HU622); 4. Sydney Peppermint-Smooth barked Apple shrubby open forest on coastal hills and plains of the southern North Coast and northern Sydney Basin (HU641); and 5. Yellow bloodwood-ironbark shrubby woodland of the dry hinterland of the Central Coast, Sydney Basin (HU657)

The Credit Profile for the Salt Ash TSSZ (Apple-Blackbutt Dune Forest) revealed that a total of 1857 Ecosystem Credits would need to be retired using one or more of five (5) different vegetation types within the Karuah Manning CMA subregion to enable clearing of the Salt Ash development site.

Tomalla Biobank Assessment

4.1 Tomalla Biobank Site

4.1.1 Landscape Value

Landscape Assessment Circles (Percentage Native Vegetation Cover)

The 100 and 1000 hectare landscape assessment circles were centered over the biobank site using AutoCAD (version 10) and Google Earth Pro imagery to visually estimate percentage native vegetation cover within each circle.

Within the 100 and 1000 ha circles, the biobank site was placed in the 71-80 and 81-90% native vegetation cover class, respectively, for before and after the biobank site establishment. Thus, there was not considered to any change in the vegetation cover class for establishing the biobank site. This was due to the fact that no site revegetation or rehabilitation of derived grassland areas is proposed at present.

The assessment circles are shown in **Figure 4.1.**

Connectivity Width

To determine the existing Linkage Width Class of the Tomalla site, it was first necessary to determine the narrowest (most limiting) link that connects site vegetation to adjoining vegetation. This link was identified in the south-west of the site as having a width of 280 metres which equates to an existing Linkage Width Class of >100-500m. The primary link from the site to adjoining vegetation is to the south.

It was then necessary to assess whether, as a result of establishing a Biobank site, there was likely to be a change in the existing Linkage Width Class as a result of certain management actions (eg. site rehabilitation, revegetation). In other words, would the Biobank site result in an improved link with a correspondingly higher Linkage Width Class.

Linkage width calculations are provided in **Table 4.1** below.

Table 4.1 - Linkage Width Classes

	Linkage Width (m)	Linkage Width Class (m)
Before Biobank	280	>100-500
After Biobank	280	>100-500

Results from **Table 4.1** show that management actions associated with the biobank site (eg. no planned rehabilitation of derived grasslands) are unlikely to improve the existing linkage width and thus will not result in a change to the linkage width class.

The primary link to the south is shown in **Figure 4.2** for the Tomalla site.

Connectivity Condition

Google Earth Pro imagery was used to determine condition of the primary link vegetation, this being the Dry and Wet Sclerophyll Forests adjoining the site to the south. The primary link vegetation was considered to be at benchmark value for overstorey and groundcover Projected Foliage Cover (PFC) for the biobank site based on ground truthing (biobank field survey) and a review of Google Earth imagery.

There is not considered to be any change in Connectivity Condition values before and after development (both remain at benchmark for overstorey and groundcover).

Threatened Species Sub Zones

A total of five (5) Threatened species sub zones (TSSZ) (analogous to vegetation types) were identified on the Tomalla site and input into the Credit Calculator. The five (5) TSSZs input into the CC are described below.

1. **TSSZ1 Forest Red Gum (Eucalyptus tereticornis) – Forest She Oak (Allocasuarina torulosa) – Apple u(Angophora floribunda) Dry Sclerophyll Woodland/Open Forest**

   This community was recorded on exposed hillslopes and crests on sedimentary bedrock and basalt. Yellow Box (*E. melliodora*) and a variety of Stringybarks (eg. *E. laevopinea, E. globoidea, E. caliginosa*) were recorded as associate canopy species. A shrubby mid stratum included *Acacia irrorata, Acacia longissima, Jacksonia scoparia, Bursaria spinosa* and juvenile eucalypts. A diverse grassy and forb groundcover included *Themeda triandra, Poa sieberiana ssp sieberiana, Cymbopogon refractus, Aristida vagans, Austrodanthonia racemosa, Echinopogon ovatus, Dichelachne micrantha* and *Elymus scaber*. This community generally comprised mixed aged stands with some historical logging practices evident in places. Weed invasion was low dominated by *Bidens pilosa* and naturalised *Sigesbeckia orientalis*.

   This community may be consistent (to some extent) with some elements of the White Box-Yellow Box-Blakelys Red Gum EEC listing under the TSC and EPBC Acts.

   This community most closely resembles Forest Ecosystem (FE) No. 43 Dry Silvertop Stringybark-Apple and Forest Ecosystem No. 44 Dry Open Red Gum-Broad leaved Apple (NSW RFA 2000). Both FE's are not listed as Endangered, Vulnerable or Rare (NSW RFA 2000) and have reached their target extent and distribution.

   Equivalent HCCREMS Vegetation Community (Somerville 2009) = MU 69 Forest Red Gum/Broad leaved Apple grassy woodland on Serpentinite at Nowendoc.

Equivalent Biobank Vegetation type = Silvertop Stringybark – Broad leaved Apple dry open forest of the gorges of the North Coast.

2. **Silvertop Stringybark (Eucalyptus laevopinea) – White topped Box (Eucalyptus quadrangulata) Dry Sclerophyll Open Forest**

   This community was recorded on sheltered hillslopes on sedimentary bedrock and basalt throughout the site. Sydney Blue Gum (*E. saligna*), Forest Oak and a variety of stringybarks and apples were recorded as associate canopy species. This community generally supported a similar floristic assemblage in the mid and lower strata as community no. 1. This community generally comprised mixed aged stands with some historical logging practices evident in places. Weed invasion was low to moderate dominated by *Bidens pilosa* and naturalised *Sigesbeckia orientalis*.

   This community most closely resembles Forest Ecosystem No. 162 White topped Box which is listed as 'Rare' having a total extant area < 1000 hectares (NSW RFA 2000).

   Equivalent HCCREMS Vegetation Community (Somerville 2009) = MU 39 Sydney Blue Gum/New England Blackbutt/White top Box moist shrub/grass open forest of the lower North Coast.

   Equivalent Biobank Vegetation type = White-topped Box open forest of the escarpment ranges of the North Coast.

3. **Sandpaper Fig (Ficus coronata) – Whalebone Tree (Streblus brunonianus) Dry/Warm Temperate Rainforest**

   This community was recorded along dry, rocky watercourses that drain the site including along Tomalla Creek and its tributaries (as well as finger gullies of Pigna Barney River) on basalt. Canopy associates included *Backhousia myrtifolia, Diospyros australis, Schizomeria ovata, Pittosporum undulatum, Alectryon subcinereus, Notelaea longifolia* and *Myrsine variabilis*. This community supported a sparse to dense shrub stratum dominated by *Pittosporum spinescens, Breynia oblongifolia, Maytenus silvestris, Solanum aviculare* and *Eleaocarpus obovatus* as well as a diverse groundcover dominated by ferns and climbers (woody and herbaceous). Supported a mix of dry and warm temperate rainforest species.

   This community most closely fits Floyd's Dry Rainforest Suballiance No. 23 Ficus-Streblus-Dendrocnide-Cassine (Floyd 1990). This community has structural and floristic affinities with the Lower Hunter Valley Dry Rainforest Vulnerable Ecological Community listing under the TSC Act. Whilst this listing is meant to capture dry rainforest gullies generally under 300 m elevation (Tomalla elevations range between 700-900m AHD), there are close floristic affinities between the Tomalla site and the EEC listing.

   This community most closely resembles Forest Ecosystem no. 168 Rainforest, listed as Rare (NSW RFA 2000).

   Equivalent HCCREMS Vegetation Community (Somerville 2009) = MU 6 Sandpaper Fig-Whalebone Tree Warm Temperate Rainforest.

Equivalent Biobank Vegetation type = Fig-Whalebone Tree-Stinging Tree dry rainforest of the southern North Coast.

4. **River She Oak (Casuarina cunninghamiana subsp. cunninghamiana) Dry Sclerophyll Forest**

This community was recorded along Pigna Barney River (permanent watercourse) and along small broad sections of Tomalla Creek on granite. River She Oak was generally confined to the streambed whilst minor subsidiary canopy species were recorded along the banks including Forest Red Gum, Sydney Blue Gum and Yellow Box. This community supported a sparse shrub stratum dominated by *Bursaria spinosa* and *Pittosporum undulatum* with a diverse groundcover dominated by sedges (*Carex* spp.), ferns, forbs and climbers. This community supported some older remnant trees and weed invasion was generally absent.

This community most closely resembles Forest Ecosystem No. 120 River Oak, listed as Rare (NSW RFA).

This community is not analogous to any TSC/EPBC listed EEC's.

Equivalent Biobank Vegetation Type = River Oak riparian woodland of the North Coast and northern Sydney Basin.

5. **Snowgrass (Poa sieberiana var sieberiana) Derived Grassland**

This community was recorded on the lower hillslopes in the central and northern parts of the site on sedimentary (siltstone) bedrock. The shrub and tree strata of this community has been subject to historical clearing for grazing activity with the native pasture left intact although pasture weed invasion (exotic grasses, forbs) has since compromised the native groundcover to some extent. This community would likely have once supported community no. 1 (Forest Red Gum/Forest She Oak/Apple DSF) based on its physiographic attributes, adjoining intact habitats and the author's knowledge of local vegetation types. Permanent removal of stock would be expected to facilitate natural regeneration of this community (at least to some extent) given the source of adjoining propagules, intact native soil seedbank (long seed viability) and based on the author's experience of the natural regenerative capacity of this vegetation type on the tablelands. Assisted revegetation would likely be required to assist in re-establishing a native overstorey through a combination of stock exclusion, weed control, soil amelioration and tubstock plantings.

This community has the potential to be regenerated back to a grassy woodland community containing elements of the TSC/EPBC listed White Box -Yellow Box-Blakelys Red Gum EEC.

Equivalent Biobank Vegetation type = Derived grasslands of the Upper slopes, ridge tops and frost hollows of the Upper Hunter and Barrington Ranges.

All 5 TSSZs ere considered to have a 'Moderate/Good' Condition Class as they did not meet the criteria for 'Low Condition' and generally had benchmark PFC values for overstorey and/or groundcover.

No 'ancillary code' was given to the five (5) TSSZs as the vegetation types were generally homogenous (eg. weeds were minimal and evenly distributed).

Data for Percentage Native Vegetation Cover, Connectivity and TSSZs combined to give the biobank site a Landscape Score of 12.

The TSSZ's are shown in **Figure 4.3.**

Adjacent Remnant Vegetation Area

Adjacent Remnant Vegetation Area (ARVA) is defined as the area of Moderate/Good vegetation on and adjoining the biobank site. Google Earth pro imagery was used to visually estimate the ARVA (via the primary link to the south) for each of the five (5) TSSZ's.

The ARVA visually estimated for the biobank TSSZ's site easily exceeded the 500 hectare threshold (size class) giving the site an ARVA value of 501. No further ARVA mapping was thus undertaken beyond the 500 hectare threshold.

ARVA polygon encompassing the biobank site and adjoining vegetation is shown in **Figure 4.4**.

Patch Size

Patch Size is defined as ARVA plus low condition vegetation on and/or adjoining the biobank site. There is not considered to be any low condition vegetation on or adjoining the biobank site up to the 500 hectare threshold and thus patch size was calculated to be the same as the ARVA value, this being 501.

4.2 Geographic and Habitat Features

Step 2 in the Credit Calculator asks whether any part of the biobank site occurs 'on' 13 listed Geographic and Habitat Features (GHFs). The biobank site was considered to occur on all of the following 13 GHFs listed in the Credit Calculator:

- Hollow-bearing trees, bridges, caves or artificial structures within 200 m of riparian zone
- land containing caves or similar structures;
- land containing escarpments, cliffs, caves, deep crevices, old mine shafts or tunnels
- land within 1 km of rock outcrops or clifflines;
- land within 100 m of permanent streams or swamps containing emergent aquatic or riparian vegetation or fallen timber
- land within 40 m of rainforest, coastal scrub, riparian or estuarine communities;

- land within 40 m of watercourses, containing hollow-bearing trees, loose bark and/or fallen timber;
- moist areas in grassy tall open forest or near rainforest edges;
- rainforest or tall open wet forest with understorey and/or leaf litter and within 100 m of streams;
- red-brown loams above 900m in altitude;
- wet sclerophyll forest or land within 100 m of streams or permanent soaks;
- land above 400 m altitude in Barrington CMA subregion; and
- land north of Gloucester in Karuah Manning CMA subregion.

4.3 Identified Populations

There are no Identified Populations relevant to the Tomalla biobank site.

4.4 Threatened Species 'Species Credits'

Step 4 of the Credit Calculator (CC) requires the proponent to undertake a Site Survey targeting a total of 16 Threatened species and populations predicted by the CC's Threatened Species filter as possible site occurrences (that is, only for those species where 'Species Credits' apply). The proponent has undertaken biobank surveys (flora) and limited Threatened fauna surveys on the biobank site to identify listed Threatened species occurring on the site. The surveys are described below.

4.4.1 Flora Surveys

No Threatened flora species were recorded during the biobank surveys.

The Dry Sclerophyll Forest and Derived Grassland communities recorded on the site represent habitat for the Threatened herb *Thesium australe*. The Hunter Central Rivers CMA note that *Thesium australe* has been recently recorded on the Tomalla plateau in *Poa sieberiana* Derived Grassland (pers. comm. Mr Paul Melehan, HCR CMA, January 2010).

The site also represents habitat for the Threatened species *Eucalyptus oresbia* (recorded in similar habitats between Nundle and Mernot), *Cynanchum elegans* (rainforest gullies) and Barrington tops Ant Orchid *Chiloglottis platyptera*.

4.4.2 Fauna Surveys

Orogen (on behalf of ATB Morton), engaged Mr Russell Jago, a fauna ecologist, to undertake fauna surveys on the site in conjunction with the supplementary biobank surveys in March 2011.

Fauna surveys were undertaken on 2-3 March 2011 to inventory site fauna (including Threatened fauna) and comprised:

- Diurnal bird surveys;
- Destructive habitat searches for reptiles and amphibians;
- Anabat detection targeting microbats;
- Call playbacks targeting the Koala, large forest owls; and
- Spotlighting.

Three (3) Threatened (TSC listed) fauna species were recorded during the fauna surveys, these being the Glossy Black Cockatoo (*Calyptorhynchus lathami*), Scarlet Robin (*Petroica boodang*) and Hastings River Mouse (*Pseudomys oralis*). Two breeding cockatoo pairs were observed feeding on a single Forest Oak in Biobank plot 23 (Red Gum-Forest Oak-Apple DSF). Some of the older remnant hollow bearing trees on the site represent potential nesting habitat for this species.

The Scarlet Robin was observed perching on a branch of a stringybark near plots B20 and B21 in Box Stringybark Moist Sclerophyll Forest.

A confirmed scat of the Hastings River Mouse was recorded in a forested gully just downslope from Biobank Plot no. 26 amongst dense grassy groundcover. The species is known from Barrington Tops NP to the south of the subject site. The Tomalla/Barrington records likely represent the southern limit of the species and thus are considered to be of State significance. The biobank site thus represents known habitat for the Hastings River Mouse which generates a total of 50 Species Credits for the site.

The biobank site represents potential habitat for the 'Species Credit' Threatened species listed in the Credit Calculator for the biobank site, these being Callocephalon fimbriatum, Chalinolobus dwyeri (Breeding Habitat), Chiloglottis platyptera, Circus assimilis, Cynanchum elegans, Eucalyptus oresbia, Hieraaetus morphnoides, Hoplocephalus bitorquatus, Litoria daviesae, Macropus parma, Mixophyes balbus, Myotis macropus (formally Myotis adversus) (Breeding Habitat), Petrogale penicillata, Phascogale tapoatafa, Philoria sphagnicolus, Pseudomys gracilicaudatus and Pteropus poliocephalus (Breeding Habitat.

4.4.3 Vegetation Plot/Transect Data

An initial biobank survey was undertaken over a 3 day period (15-17 December 2009) by Orogen Senior Botanist Isaac Mamott wherein a total of nineteen (19) biobank plots (400 m^2 dimension) were carried out across the site within five vegetation communities. An additional 11 biobank plots and transects were carried out by Orogen Senior Botanist Isaac Mamott on 2-4 March 2011 to gain a further appreciation of the nature and extent of vegetation communities across the site (targeting areas not ground truthed during the initial surveys). Information on vegetative structure, floristics as well as physiographic data (slope, aspect, elevation, topographic position, degree of disturbance, hollow bearing trees, fallen logs) were recorded on field data sheets.

The extent of vegetation communities recorded on the site were digitised onto Google Earth Pro imagery using AutoCAD 2010. Polygon linework was further refined following the completion of the additional biobank plots in March 2011.

The structural classification used for mapping and vegetation community descriptions follows Walker and Hopkins (1990). Subformation names for vegetation types other than rainforest have been adapted from the classification proposed by Beadle and Costin (1952) (eg. dry and wet sclerophyll forest). The subformation categories of Floyd (1990) are used for rainforest communities. Vegetation communities are named after dominant indicator species of the tallest stratum and considered as 'associations' using the definition of Beadle (1981). Botanical nomenclature follows Harden (1990-1993; 2000), the Royal Botanic Gardens *PlantNet* website and recent prescriptions in relevant botanical journals.

Biobank plot locations are shown on **Figure 4.1.**

Deviations from the Biobank Assessment Methodology

The Biobank assessment methodology and operational manual (2009) requires that 400 m^2 (20m x 20m) floristic plots be nested within 1000 m^2 (20m x 50m) biobank plots and that counting of hollow bearing trees and fallen log lengths be undertaken in the larger plot areas (species counts need only be undertaken in the smaller plot areas). During the study, hollow bearing tree counts and log lengths were carried out in the smaller floristic plots only in order to save time and maximise the number of supplementary biobank plots undertaken (setting up the 2 plot areas is typically very time consuming). This is not seen as a limitation to the study as the results from this method would have under-estimated these habitat attributes for each plot (rather than over-estimated them).

Limitations

Access to the south-west portion of the site (south-west of Tomalla Creek) was difficult due to the inherent steepness of the terrain and absence of access tracks (compounded by wet weather experienced during the surveys) which ultimately prevented further ground truthing in this area.

High resolution digital imagery was not available for the Tomalla site from the LPMA and thus the study relied on Google Earth Pro imagery for the vegetation mapping. The relatively poor resolution of Google Earth Pro imagery poses inherent limitations in the vegetation mapping. Nevertheless, the additional ground truthing undertaken as part of the supplementary biobank surveys helped to overcome this limitation to some extent. As a result, the vegetation mapping can be regarded as reasonably accurate for the purposes for which it was prepared or intended. Whilst further refinement of vegetation mapping could be undertaken once high resolution digital imagery was made available, this would not be expected to result in significant changes to the results of the biobank assessment (in terms of the overall number of biodiversity credits to be earned from the five (5) vegetation communities recorded on the site).

Transect/plot data was entered into Step 5b of the Credit Calculator for the site's TSSZs and is shown below in **Tables 4.2-4.6**.

Table 4.2 - Plot/Transect Data – Silvertop Stringybark-Broad leaved Apple dry open forest of the gorges of the North Coast (TSSZ 1 – 6 minimum plots required)

Plot No.	Plant Species Richness	Native Over Storey Cover	Native Mid Storey Cover	Native Ground Cover (grasses)	Native Ground Cover (shrubs)	Native ground cover (other)	Exotic Plant Cover	# Hollow Trees	Over Storey Regeneration	Length of Fallen Logs	AMG Grid Refs (WGS84)
B21	37	34	24	64	42	78	28	1	.4	4	363279; 6480422
B23	37	28.5	18	86	24	74	8	1	1	10	362463; 6481808
B24	39	31	16.5	80	32	80	8	1	1	12	362808; 6481802
B25	37	22.5	15	78	22	74	1	1	1	8	362869; 6481343
B26	33	29	13.5	80	28	74	.8	2	.66	8	362812: 6481156
B27	42	30	17	68	22	74	0.8	0	0.66	6	363276: 6481330

Table 4. 3 - Plot/Transect Data – White topped Box open forest of the escarpment ranges of the North Coast (TSSZ 2; 5 minimum plots required)

Plot No.	Plant Species Richness	Native Over Storey Cover	Native Mid Storey Cover	Native Ground Cover (grasses)	Native Ground Cover (shrubs)	Native ground cover (other)	Exotic Plant Cover	# Hollow Trees	Over Storey Regeneration	Length of Fallen Logs	AMG Grid Refs (WGS84)
T20	31	36	20	86	30	60	4	1	0	15	362973: 6479921

Table 4. 3 - Plot/Transect Data – White topped Box open forest of the escarpment ranges of the North Coast (TSSZ 2; 5 minimum plots required)

Plot No.	Plant Species Richness	Native Over Storey Cover	Native Mid Storey Cover	Native Ground Cover (grasses)	Native Ground Cover (shrubs)	Native ground cover (other)	Exotic Plant Cover	# Hollow Trees	Over Storey Regeneration	Length of Fallen Logs	AMG Grid Refs (WGS84)
B19	36	38	22	56	36	64	14	1	0.5	8	363121: 6480092
B20	42	40	24	56	22	62	20	2	0.66	15	362999: 6479892
B28	29	35	14.5	86	14	68	4	0	0.75	10	361842: 6481639
B29	36	35	20	78	26	84	10	1	0.6	6	361708: 6481700

Table 4. 4 - Plot/Transect Data – Fig-Whalebone Tree-Stinging Tree dry rainforest of the southern North Coast (TSSZ 3; 3 minimum plots required)

Plot No.	Plant Species Richness	Native Over Storey Cover	Native Mid Storey Cover	Native Ground Cover (grasses)	Native Ground Cover (shrubs)	Native ground cover (other)	Exotic Plant Cover	# Hollow Trees	Over Storey Regeneration	Length of Fallen Logs	AMG Grid Refs (WGS84)
T19	35	72	10	0	30	30	2	0	0	30	363202; 6480466
B22	45	57	24	24	14	36	6	1	1	14	362293; 6481859
T10	24	75	18.5	0	12	42	2	0	0	15	361646; 6481912

Table 4. 5 - Plot/Transect Data – River Oak riparian woodland of the North Coast and northern Sydney Basin (TSSZ 4; 1 minimum plot required)

Plot No.	Plant Species Richness	Native Over Storey Cover	Native Mid Storey Cover	Native Ground Cover (grasses)	Native Ground Cover (shrubs)	Native ground cover (other)	Exotic Plant Cover	# Hollow Trees	Over Storey Regeneration	Length of Fallen Logs	AMG Grid Refs (WGS84)
T2	32	36	0	28	0	36	14	1	0	10	362303; 6482560

Table 4. 6 - Plot/Transect Data – Derived grasslands of the upper slopes, ridge tops and frost hollows of the upper Hunter and Barrington Ranges (TSSZ 5 – 4 minimum plots required)

Plot No.	Plant Species Richness	Native Over Storey Cover	Native Mid Storey Cover	Native Ground Cover (grasses)	Native Ground Cover (shrubs)	Native ground cover (other)	Exotic Plant Cover	# Hollow Trees	Over Storey Regeneration	Length of Fallen Logs	AMG Grid Refs (WGS84)
T5	10	0	0	100	0	38	40	0	0	0	362330; 6482278
T6	10	0	0	58	0	0	68	0	0	0	362140; 6482329
T7	10	0	0	80	0	0	86	0	0	0	362174; 6482195
TDum	10	0	0	80	0	0	50	0	0	0	362513; 6482333

4.4.4 Management Zones

Given the homogeneity of vegetation within each TSSZ, a single management zone was entered into the Credit Calcuartor (for all 5 TSSZs). Post biobank management zone attribute scores (for vegetation cover, plant species richness, etc.) were kept at default scores as no significant revegetation, weed

control or feral animal control (over and above standard management actions) is proposed for the Tomalla site.

4.4.5 Threatened Species Survey Data

None of the listed 'Species Credits' Threatened species and populations were input into the Credit Calculator as being recorded on the biobank site. One 'additional' Species Credit Threatened Species, *Pseudomys oralis*, was input as being recorded on the biobank site.

4.5 Credit Report

The Credit Calculator (v1.2) was 'run' with the data input as described in Sections 4.1-4.4 and generated a Credit Profile for the biobank site as shown below in **Tables 4.6-4.7**.

Table 4. 7 - Credits Generated for Tomalla Biobank site

Biobank Vegetation Type	Site Area (hectares)	Ecosystem Credits Generated
Silvertop Stringybark-Broad leaved Apple Dry Open Forest of the gorges of the North Coast	222.3	2193
Fig-Whalebone Tree-Stinging Tree Dry Rainforest of the southern North Coast	19.6	121
White topped Box open forest of the escarpment ranges of the North Coast	51.4	548
River Oak Riparian Woodland of the North Coast and northern Sydney Basin	1.9	20
Derived Grasslands of the upper slopes, ridge tops and frost hollows of the Upper Hunter and Barrington Rangesj	49.3	210
	Total Area = 344.5	**Total Credits = 3092**

Table 4. 8 - Credit Profile – All Five (5) TSSZs

Surrounding Vegetation Cover Class (%)	Patch Size (ha)	CMA Subregion
>70	>100	Tomalla

Biobank Credit Comparison

5.1 Comparison between Salt Ash and Tomalla

A review of the credit profiles for the development and biobank sites revealed that an ecosystem credit 'match' was not made. In other words, the Tomalla biobank site had none of the vegetation types required to offset the Salt Ash development site.

However, as discussed in Section 1.2, the Proponent is able to apply the OEH Interim Policy on Biodiversity Offsetting which allows a more flexible offsetting scenario wherein credits can be 'matched' using broad vegetation 'formations'. With respect to Tomalla and Salt Ash, the 1,857 Dry Sclerophyll Forest credits needed to offset the sand quarry can (and are proposed to) be offset using 1857 of the available 2,193 credits generated by the Silvertop Stringybark-Broad leaved Apple Dry Sclerophyll Open Forest of the gorges of the North Coast vegetation type (the 'Dry Sclerophyll Forest' formations are common between the 2 sites). This leaves the Proponent with a 'surplus' of 336 ecosystem credits for the Silvertop Stringybark-Broad leaved Apple TSSZ.

Management of the Biobank Site

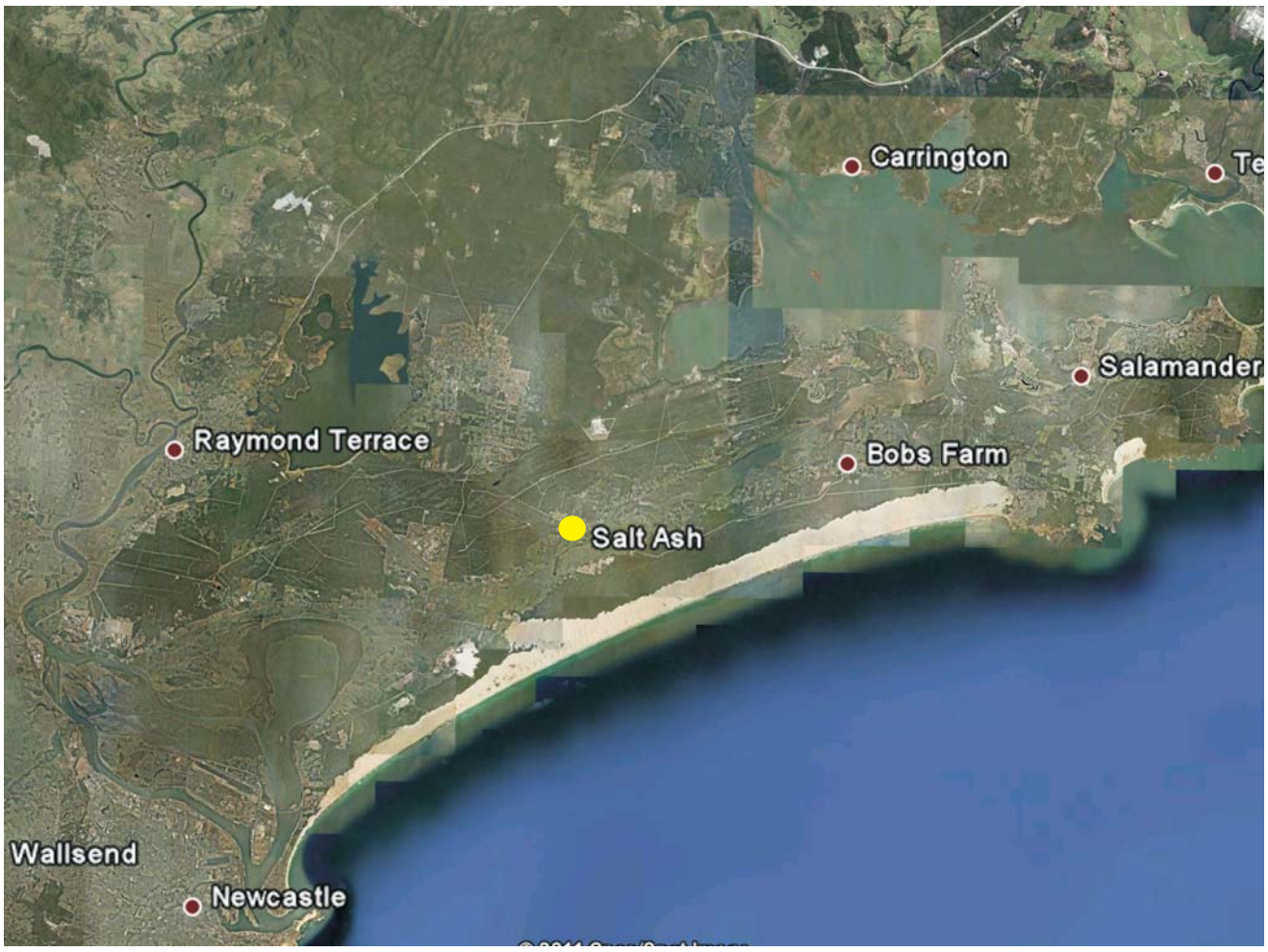
6.1 Standard Management Actions

The Tomalla biobank site is in excellent condition with minimal weed coverage recorded at all biobank survey plots.

No revegetation of the derived grassland areas is proposed at present.

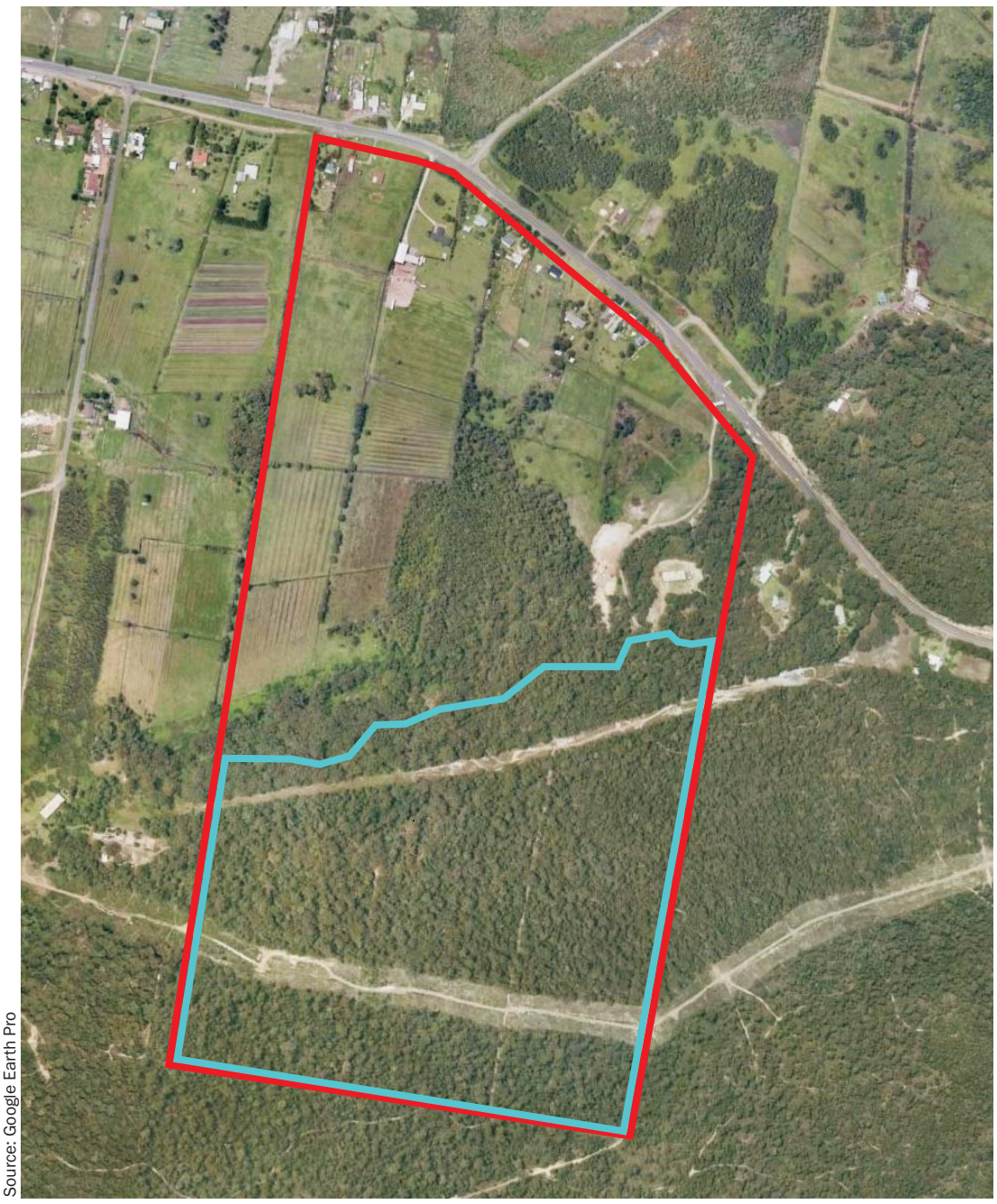
Standard management actions such as maintenance fencing, 3 yearly inspections for noxious weeds, trail maintenance and periodic hazard reduction burning would be undertaken.

Figures



LEGEND

Site Location



Source: Google Earth Pro

NOTES:
1. Map indicative only
2. Map to be printed in A3

LEGEND

Site Boundary
Study Area

Figure 2.1 - Site Location - Salt Ash Development Site

Orogen Pty Ltd
411021_REO_001_Figure 2.1

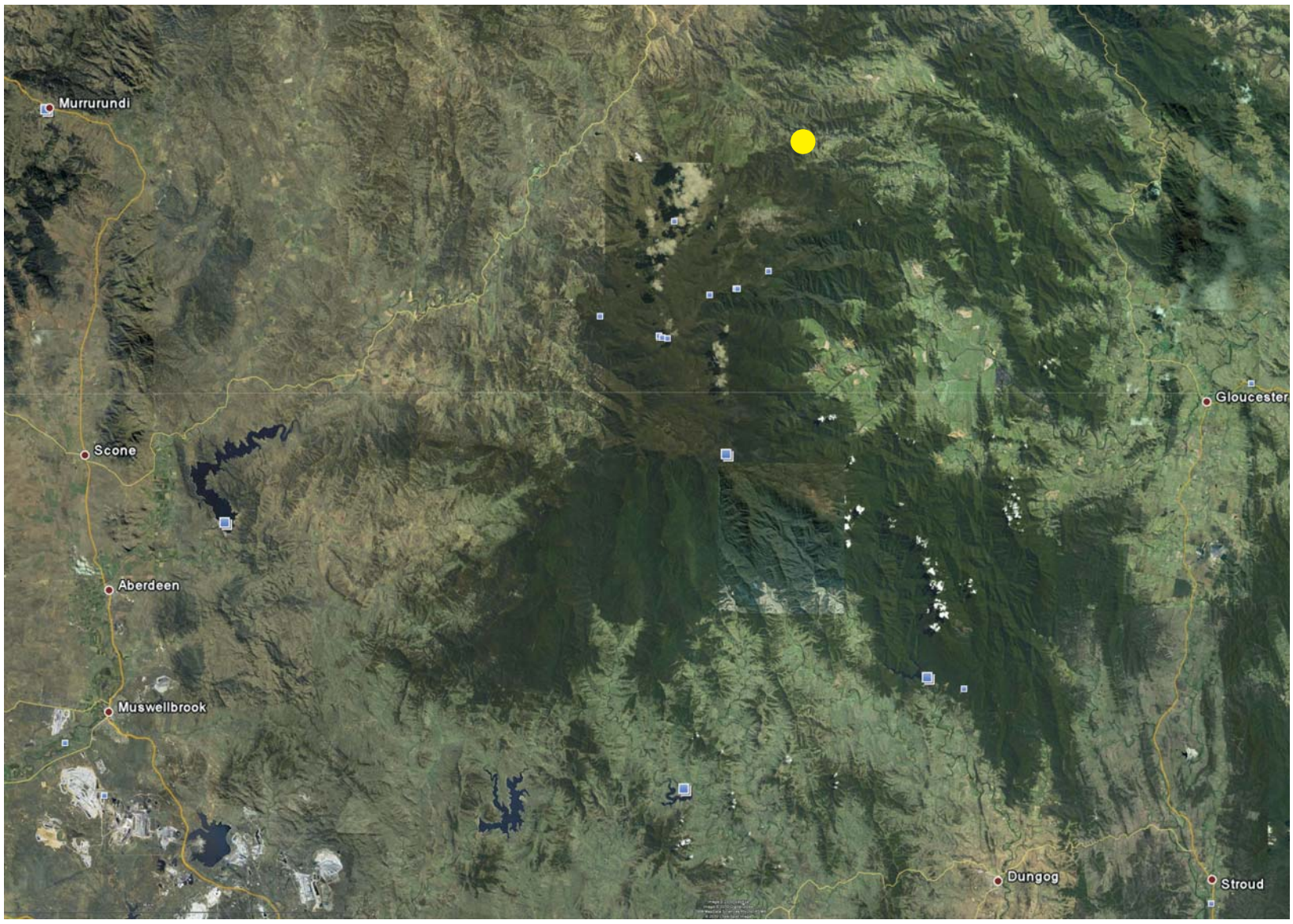


Figure 2.2 - Site Location - Tomalla Offset Site

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411021_REO_001_Figure 2.2

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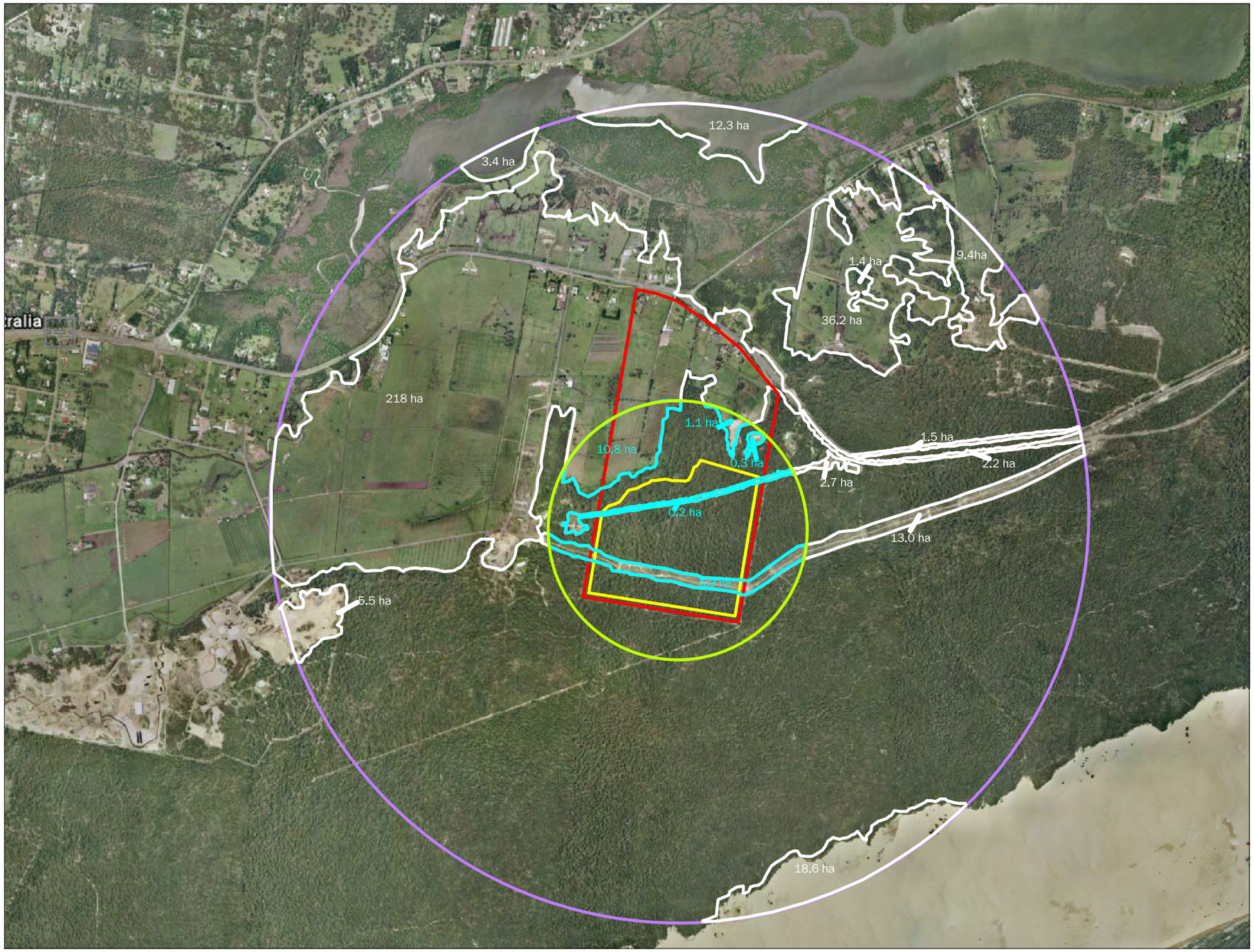

LEGEND

- Site Boundary
- Quarry Extraction Footprint
- 100 ha landscape assessment circle
- 1000 ha landscape assessment circle
- Polygon of cleared areas (1000 ha) - shown as white
- Polygon of cleared areas (100 ha)

Figure 3.1 - Salt Ash Assessment Circles and Polygons

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411021_REO_001_Figure 3.1

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LEGEND

- Site Boundary
- Primary Link(s) to connecting vegetation
- Primary Linkage Width (after development)
- Primary Linkage Width (before development)
- Development Site Boundary (extraction footprint excluding 2 easements)

Figure 3.2 - Primary Link Vegetation and Linkage Widths Before and After Salt Ash Development

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411021_REO_001_Figure 3.2

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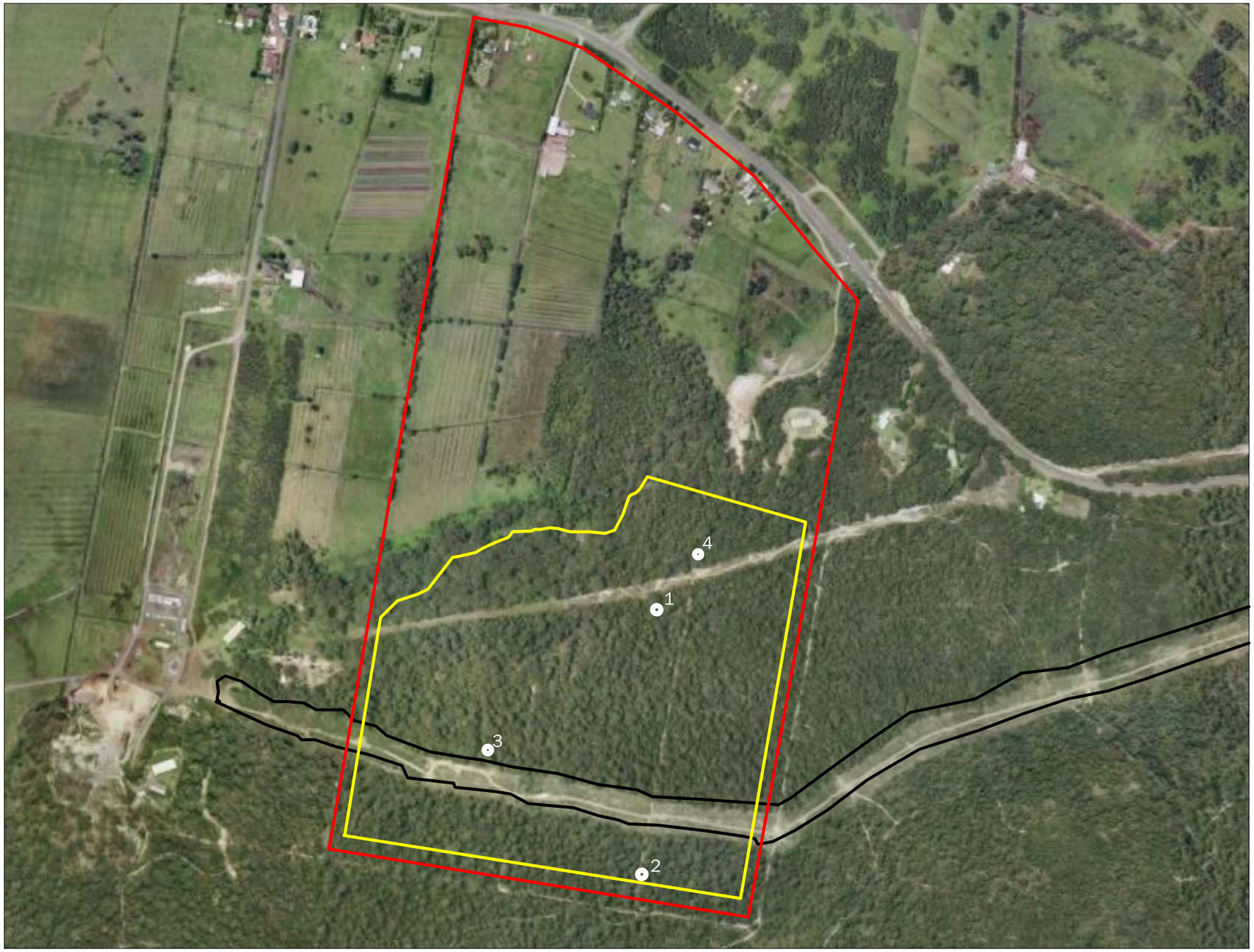

LEGEND

- Site Boundary
- Extraction Footprint
- One vegetation type recorded in the extraction footprint. This being Blackbutt/apple Dry Sclerophyll Dune Forest.
- Biobank Survey Sites, April 2009 (shown as white)

Note: Northern and Southern easements are outside the extraction footprint and are not subject to extraction.

Figure 3.3 - Salt Ash Threatened Species Sub Zone (TSS2) and Survey Sites

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411021_REO_001_Figure 3.3

LEGEND

- Site Boundary
- Quarry Extraction Footprint
- Adjacent Remnant Vegetation Area and Patch Size

Note: Polygon (blue) was closed once ARUA size class exceeded 500ha.

Figure 3.4 - Salt Ash Adjacent Remnant Area Vegetation and Patch Size

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411021_REO_001_Figure 3.4

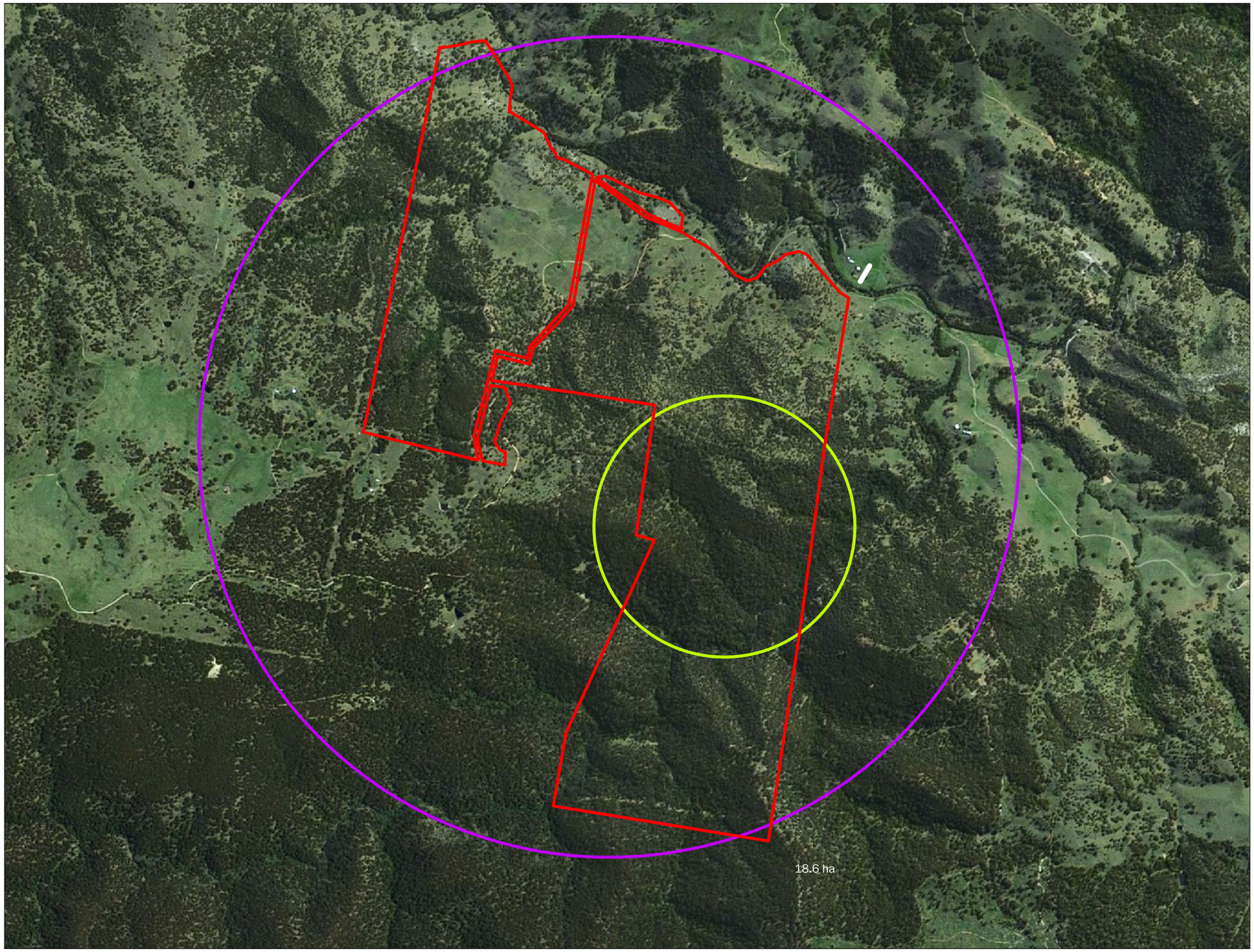

Figure 4.1 - Tomalla Assessment Circles and Polygons

Orogen Pty Ltd
411021_REO_001_Figure 4.1

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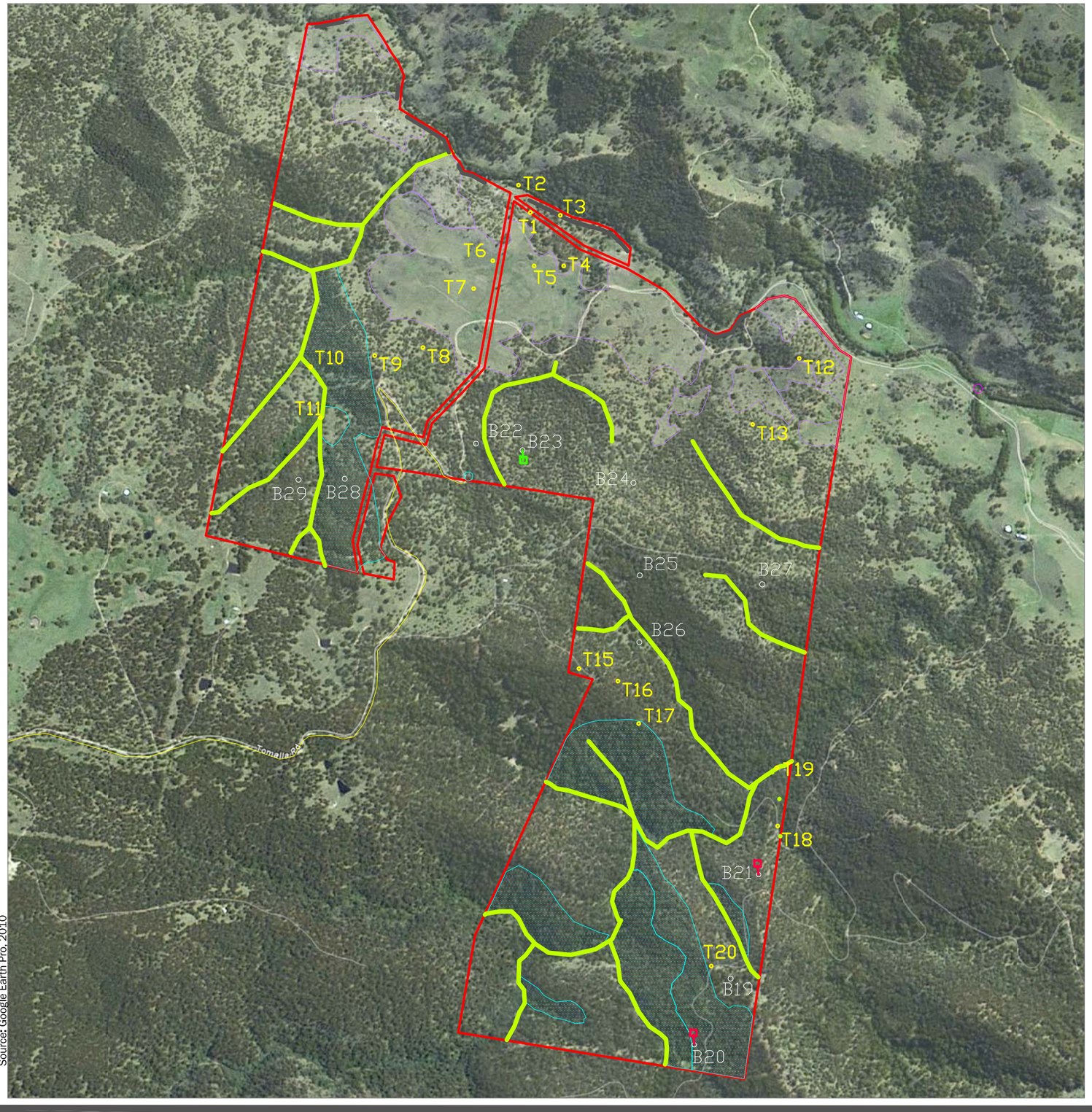
LEGEND

- Site Boundary
- Primary Link(s) to connecting vegetation
- Primary linkage widths

Figure 4.2 - Primary Link Vegetation and Linkage Widths Before Tomalla



Source: Google Earth Pro, 2010

LEGEND

- Site Boundary

Biobank Vegetation Types

- Silvertop Stringybark (Eucalyptus laevopinea) - White topped Box (Eucalyptus quadrangulata) Dry Sclerophyll Open Forest
- Sandpaper Fig (Ficus coronata) - Whalebone Tree (Streblus brunonianus) Dry Rainforest
- River She Oak (Casuarina cunninghamiana subsp. cunninghamiana) Dry Sclerophyll Forest
- Snowgrass (Poa sieberiana var sieberiana) Derived Grassland
- Forest Red Gum (Eucalyptus tereticornis) - Forest She Oak (Allocasuarina torulosa) - Apple (Angophora floribunda, Angophora subvelutina) Dry Sclerophyll Open Forest

T1 Initial Biobank Survey Sites, December 2009

B1 Supplementary Biobank Survey Sites, March 2011 (shown as white)

- Anabat Detection
- Call Playback Locations
- Spotlighting Transect
- Scarlet Robin
- Glossy Black Cockatoo

NOTES

1. Map indicative only.
2. Map to be printed in A3.
3. Bird, frog and reptile surveys were undertaken at each Biobank Survey site.
4. Spotlighting Transect continued offsite on the Tomalla Plateau.

Figure 4.3 - Tomalla Threatened Species Sub Zone (TSS2) and Survey Sites

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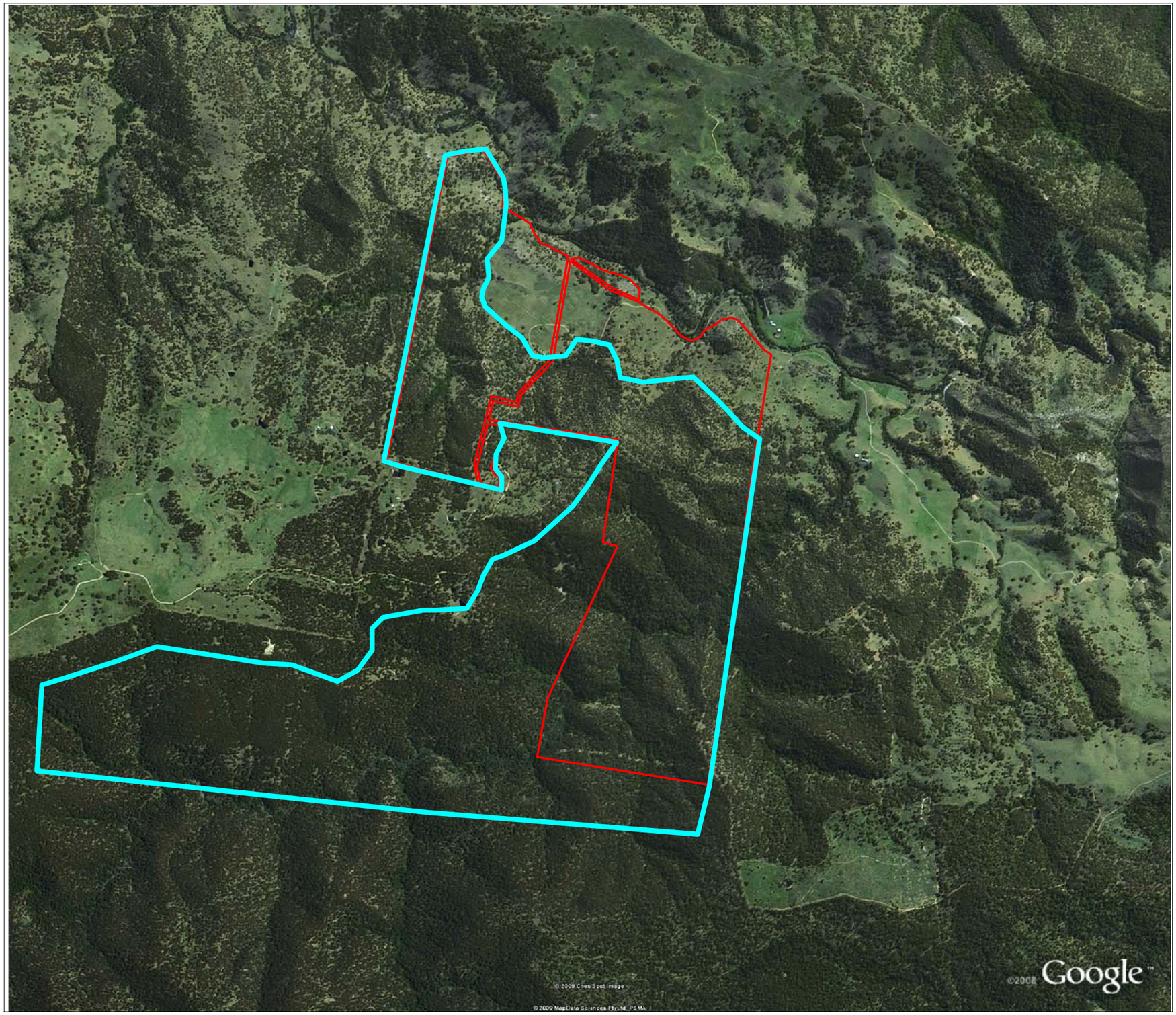

Note: Polygon (blue) was closed once ARUA size class exceeded 500ha.

Figure 4.4 - Tomalla Adjacent Remnant Area Vegetation and Patch Size

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411021_REO_001_Figure 4.4

Appendix A

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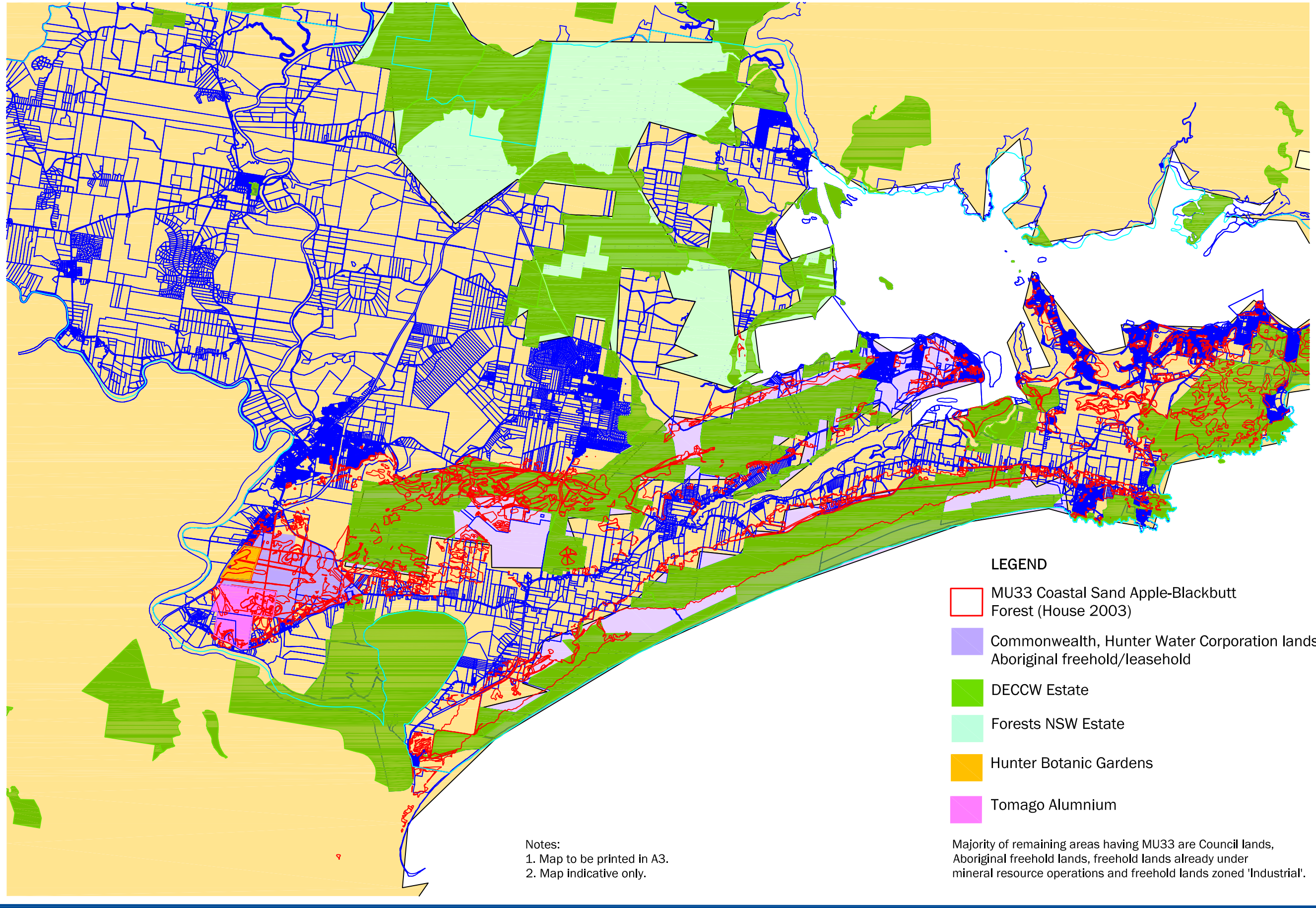

Figure 5.1 - Land Use - Vegetation Overlay