APPENDIX 10 – ENVIRONMENTAL MANAGEMENT PLAN

Environmental Management Plan

For the
Catherine Hill Bay Rosegroup Site

Prepared for
Rosegroup Pty Ltd
51 Reiley Street
Woolloomooloo NSW 2011

Job Reference 24619 - February 2009

HARPER SOMERS O'SULLIVAN

PLANNING · SURVEYING · ECOLOGY

A member of RPS Group Plc

Prepared By:
RPS Harper Somers O'Sullivan
PO Box 428
Hamilton NSW 2303
Tel: (02) 4961 6500
Fax: (02) 4961 6794
Web: www.rpshso.com.au

PROJECT: ENVIRONMENTAL MANAGEMENT PLAN - ROSEGROUP LANDS, CATHERINE HILL BAY	
CLIENT:	*ROSEGROUP PTY LTD*
OUR REFERENCE:	*24619*
DATE:	*FEBRUARY 2009*
APPROVED BY:	*MAYA BERETTA*
SIGNATURE:	
CHECKED BY:	*TOBY LAMBERT*
SIGNATURE:	

EXECUTIVE SUMMARY

INTRODUCTION

RPS has been commissioned by Rosegroup to prepare a Environmental Management Plan (EMP) to cover Environmental Management Factors on Rosegroup owned lands at Catherine Hill Bay, NSW. This plan will include vegetation mapping, vegetation clearing minimisation principals and protection measures for threatened species recorded within the site.

Should all the measures addressed within these Environmental Management Guidelines be adopted then the integrity and ecological value of the preserved bushland can be maintained within the community land in the long term. These guidelines instil an awareness of environmental management practices and create a sense of responsibility for the residents of the subdivision. This awareness and responsibility should then translate into effective management of those natural areas for future generations to enjoy.

The scope of this EMP is specifically address several conditions of consent including to;

- Provide accurate Vegetation Mapping of the site;
- Define measures to protect the White-bellied Sea Eagle nest present within the site;
- Define measures to minimise the amount of vegetation cleared as part of the proposal;
- Provide accurate mapping of the mature and hollow bearing trees within development hamlet 6;
- Provide guidance on preferred species for inclusion in the sites landscaping plan; and
- Management principals and protection mechanisms for the drainage lines within the Catherine Hill Bay site.

VEGETATION MANAGEMENT

Remnant Littoral Rainforest, which classifies as an Endangered Ecological Community under the Threatened Species Conservation Act, 1995, was located and mapped within the Catherine Hill Bay site. Previous site mapping was updated to include the area of Littoral Rainforest.

Two threatened plants, *Tetratheca juncea* (Black-eyed Susan) and *Cryptostylis hunteriana* (Leafless Tongue Orchid) have been located within development hamlet 6 of Catherine Hill Bay. Populations of these species have also been located within the offset lands and are larger than those found within the development estates. A Plan of Management for *Tetratheca juncea* has been developed for the Rosegroup Catherine Hill Bay lands and is included as an appendix to this report.

Weeds are an issue of concern within the Catherine Hill Bay site. Recommended control measures are outlined for the site's three major weed species, Lantana, Privet and Bitou Bush.

FAUNA MANAGEMENT

Mature and hollow bearing trees, which provide habitat for a range of native fauna, were mapped and counted within Development Hamlet 6. Some of the hollows were observed in stag (dead) trees.

A known, active, White-bellied Sea Eagles nest exists within the Rosegroup Catherine Hill Bay site near the quarry in the southern part of the conservation estates. This site is to be protected from negative impacts resulting from the development by a 250m buffer. Recommended clearing protocols also protect this species by ensuring that clearing does not take place during fauna breeding or fledging periods. This clearing protocol will also protect other threatened fauna that have been recorded within the area including the Masked Owl and Glossy Black-Cockatoos during their breeding periods.

SEPP 14 WETLAND

The SEPP 14 wetland adjacent to the subject site will be protected through the implementation of a series of nutrient, sediment and stormwater control measures, combined with a 50m buffer.

RECOMMENDATIONS

The potential impacts arising from the proposed development are considered to be minimal provided precautions are followed to minimise negative ecological impacts. A number of mitigation measures could be implemented to further reduce potential impacts. Recommended mitigation measures are:

- Retain a buffer of 250m surrounding the White-bellied Sea Eagle Nest;
- Strict management of stormwater runoff from the development lands;
- Nutrient and sediment control devices must be erected pre-clearing and post construction in sensitive areas where degradation processes may be triggered. Such locations include adjacent to watercourses and drainage lines until suitable rehabilitation has occurred to maintain the stability of the surface. Stockpiles should be subject to individual sediment and nutrient control devices.
- Wetland vegetation must be protected by a 50m buffer within which no landuse that may impact upon the potential of the buffer to protect wetland vegetation should be permitted. This buffer should consist of fringing vegetation but where no vegetation exists, the area should be revegetated with appropriate species such as plants from the genus of *Melaleuca* (Paperbarks), *Leptospermum* (Tea-Trees), *Gahnia* (Sedges), *Dianella* (Flax Lilies) and *Lomandra* (Mat-Rushes).

- If these buffers are unable to be implemented, additional control measures should be investigated in consultation with experienced wetland hydrogeologists and engineers to ensure that potential impacts are minimised.

- Lopping of branches to facilitate construction without the need to remove vegetation;

- Retention of vegetation wherever possible along drainage lines to prevent increased erosion and sedimentation while also maintaining existing fauna corridors and food resources;

- Mature and / or hollow-bearing trees should be retained wherever feasible and with regards to public safety within the development framework.

- Pre-clearing inspections should be undertaken by an ecologist in wooded areas where threatened fauna species have been recorded or are considered likely to occur. This is particularly important in areas where threatened fauna have been noted during recent surveys either breeding or nest-building. No breeding attempts should be disrupted during the course of the project. This means that if threatened fauna are recorded breeding, that vegetation clearing should not commence until the young have fledged.

- During the construction phase, for any tree removal within forested areas, and in particular where hollow-bearing trees may be removed, all works should be supervised by an ecologist to recover any native fauna that are potentially displaced. Furthermore, where such risks occur, site-specific ecological advice should be sought to minimise impacts during the entire process. A clearing protocol should be adopted for the removal of trees containing suitable habitat hollows as follows (this is considered as a guideline, variations on the methods employed may be required to accommodate site specific factors):

    - All hollow bearing trees are to be flagged by an ecologist prior to the commencement of works on site.

    - Underscrubbing of the entire site should be carried out by a 4x4 tractor with a slashing deck, this will minimise the establishment of degradation processes and leave a layer of mulch to aid in soil retention in the event of adverse weather. At this time felling of non habitat trees can take place, however a matrix of trees *must* be maintained to allow animal movement into the designated refuge area.

    - After a period of two weeks, clearing of habitat trees should commence. Clearing must be carried out moving from the fringe of the matrix towards the refuge area. Trees should be 'soft felled' and inspected immediately by an ecologist for displaced fauna. All trees must be left for a minimum of two nights prior to being moved to a stockpile, to allow resident fauna to vacate tree hollows.

<u>Note:</u> Clearing should ideally take place outside of the main breeding seasons of resident fauna, preferably during late Autumn and Winter.

- Where possible, earthworks (and definitely any earthworks in the vicinity of drainage lines) should be undertaken during dry weather conditions to ensure that potential erosion events will not result in significant downstream impacts.

- Strict management of stormwater runoff from the development lands;

- Nutrient and sediment control devices must be erected pre-clearing and post construction in sensitive areas where degradation processes may be triggered. Such locations include adjacent to watercourses and drainage lines until suitable rehabilitation has occurred to maintain the stability of the surface. Stockpiles should be subject to individual sediment and nutrient control devices.

GLOSSARY OF TERMS

DBH – Diameter at Breast Height

DCP – Development Control Plan

DECC – NSW Department of Environment and Climate Change (formerly NSW National Parks and Wildlife Service, NSW Department of Environment and Conservation)

DEWHA - Commonwealth Department of Environment, Water, Heritage and the Arts.

EEC - Endangered Ecological Community

EMP – Environmental Management Plan

EP&A Act – NSW *Environmental Planning & Assessment Act 1979*

EPBC Act – Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

GPS – Global Positioning System

ha – hectare

LEP – Local Environmental Plan

LGA – Local Government Area

EMP – Environmental Management Plan

ROTAP – Rare or Threatened Australian Plants listed by Briggs and Leigh (1996)

RPS HSO – RPS Harper Somers O'Sullivan

SF – State Forest

Site – the site subject to this Report

ssp. / subsp. – sub-species

Stags – Dead Trees

TSC Act – NSW *Threatened Species Conservation Act 1995*

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FIGURES

APPENDICES

1 INTRODUCTION

RPS has been commissioned by Rosegroup to prepare a Environmental Management Plan (EMP) to cover Environmental Management Factors on Rosegroup lands at Catherine Hill Bay, NSW. This plan will encompass vegetation mapping, vegetation clearing minimisation principals, protection measures for threatened species recorded within the site as specifically required in the conditions of consent for proposed development and it's associated conservation offsets.

Should all the measures addressed within these Environmental Management Guidelines be adopted then the integrity and ecological value of the preserved bushland can be maintained within the community land in the long term. These guidelines instil an awareness of environmental management practices and create a sense of responsibility for the residents of the subdivision. This awareness and responsibility should then translate into effective management of those natural areas for future generations to enjoy.

1.1 Background

A Memorandum of Understanding (MoU) covering the site was made on 16th October 2006 between the NSW Minister for the Environment, the NSW Minister for Planning, Coastal Hamlets Pty Ltd and Lakeside Living Pty Ltd (attached as Appendix A). Both Coastal Hamlets Pty Ltd and Lakeside Living Pty Ltd are Rosegroup companies. The MoU outlines the intention to implement an Environmental Lands Offset Scheme. The proposal includes the development of up to 60ha of land at CHB and up to 26ha of land at Gwandalan and the provision of 310ha of land to conservation (transferred to DECC estate).

Previous ecological investigations have been undertaken over the past five years across various portions of the land covered by the MoU. Such investigations have mapped the vegetation within the site as well as the location of an active White-bellied Sea Eagle nest and this report aims to prepare a EMP to assist in the management of the site to ensure the long term sustainability of the site's ecological features.

1.2 Site Particulars

Locality – The site occurs on the Wallarah Peninsula and at Gwandalan on the south-eastern side of Lake Macquarie.

LGA – Lake Macquarie City Council and Wyong Shire Council

Title(s) – *CHB* - Lot 2 DP 809795, Lot 2031 DP 841175, Lot 6 DP 774923, Lot 5 DP 774923; *Gwandalan* – Lot 3 DP588205.

Area – The site includes 60ha of land to be developed at CHB, 26ha of land to be developed at Gwandalan and 310ha of land that would be dedicated as offset lands to the NSW Government.

Boundaries – The land at Gwandalan is bounded by the shores of Lake Macquarie to the north-east, Lake Macquarie State Conservation Area (SCA) to the north, private vegetated land to the west and existing residential development to the south-east. The remainder of the site extends from the coast at CHB in the east, to the shores of Lake Macquarie at Crangan Bay in the west, by the Village of CHB and

lands owned by Coal and Allied to the north and finally by Munmorah SCA to the south.

Current Land Use – Landuse at Gwandalan includes residential and recreational facilities, pastures for grazing, maintenance of parkland-type vegetation and relatively unmanaged remnant bushland. The lands at CHB include portions that have been highly disturbed by mining and large tracts of natural bushland that are not in current use.

Topography – The majority of the site is characterised by undulating low coastal hills, gently sloping to the shores of Lake Macquarie. The site rises to the headland at CHB where a steep drop to the ocean occurs.

1.3 Description of the Proposal

The majority of land subject to the proposal, collectively referred to as 'the site' is located between the coast at CHB and the shores of Lake Macquarie at Crangan Bay, with a smaller portion of land located at Kanangara Drive, Gwandalan. The site includes two proposed residential developments; the first includes development of up to 60ha at CHB and up to 26ha at Gwandalan, referred to as the 'CHB development lands' and the 'Gwandalan development lands' respectively. This report also includes consideration of the proposed provision of approximately 310ha of land to offset potential ecological impacts, referred to as the 'offset lands'. Offset or conservation lands are to be transferred to the management of the Department of Environment and Climate Change (DECC).

Rosegroup companies own approximately 400ha of land in the Lower Hunter Region which is included in the Lower Hunter Regional Strategy (LHRS) (DoP, 2007) and the Draft Lower Hunter Conservation Plan (DLHCP) (DECC, 2006) for urban development and conservation. Rosegroup companies are one of four major landowners within the region that play a significant role in achieving the LHRS's environmental and conservation outcomes and sustainable growth. In finalising the LHRS, the NSW Government reached agreement with Rosegroup companies for the dedication of 310ha (over 80 per cent) of land for conservation corridors upon receipt of development rights on 86ha (under 20 per cent).

The details of the negotiations are set out in a MoU (Appendix A) between Rosegroup companies and the NSW Government. The MoU also provides for completion of a binding agreement between the NSW Government and Rosegroup companies, a Part 3A approval process for the development proposals and a proportional adjustment of the area of offset lands to be transferred in the event that developable land areas approved vary from the scheduled areas.

The proposed offset lands are areas of high conservation value in nominated green corridors that will be dedicated to the public. The offset lands are similarly identified in the draft LHCP prepared by DECC.

The locality of the site within a regional context is presented in Figure 1-1, whilst the arrangement of the CHB development lands, Gwandalan development lands and offset lands is presented in Figure 1-2.

WARNING
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from Harper Somers O'Sullivan Pty Ltd.

LAKE MACQUARIE
Gwandalan Development Lands
NORDS WHARF
PACIFIC HIGHWAY
WALLARAH NATIONA PARK
Crangan Bay
GWANDALAN
Middle Camp
Catherine Hill Bay
LAKE MACQUARIE STATE RECREATION AREA
MUNMORAH STATE RECREATION AREA
0 0.5 1km

TITLE: Figure 1-1 Site Locality

SCALE: 1: 21000 at A3 Size **DRAWN:** S. Bishop **APPROVED:** D. Landenberger

DATUM: MGA Zone 56 (GDA 94) **DATE:** 17/8/2007

LAYOUT REF: J:\JOBS\24k\24530 Hunter Valley\Draft .... ology\Southern Lands\ALL WORKSPACES\24530 Southern Lands Location FIGURE 1-3 A-A3.wor

CONTOUR INTERVAL: N/A

JOB REF: 24619

CLIENT: Rosecorp Pty Ltd

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HARPER SOMERS O'SULLIVAN

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

TITLE:
Figure 1-2
Site Layout

CLIENT:
ROSECORP PTY LTD

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SCALE: 1: 29000 at A4 Size

DRAWN: E. Graham APPROVED: D. Landenberger

DATUM: MGA Zone 56 (GDA 94) DATE: 22/11/2007

LAYOUT REF: J:\JOBS\24k\24619 - Gwandalan\Draftin .... nfo\24619.FIG2.SiteLayout.221107.wor

CONTOUR INTERVAL: N/A

JOB REF: 24619

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241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

1.4 Scope of the Study

The scope of this EMP is to;

- Provide accurate Vegetation Mapping of the site;
- Define measures to protect the White-bellied Sea Eagle nest present within the site;
- Define measures to minimise the amount of vegetation cleared as part of the proposal;
- Provide accurate mapping of the mature and hollow bearing trees within the development hamlet 6;
- Provide guidance on preferred species for inclusion in the site's landscaping plan; and
- Management principals and protection mechanisms for the drainage lines within the Catherine Hill Bay site.

1.5 Qualifications and Licensing

1.5.1 Qualifications

The EMP was undertaken by the following ecologists from RPS HSO (Refer to Appendix D for Personnel Qualifications):

- Matt Doherty (BLMC),
- Toby Lambert (B Env Sc),
- Deborah Landenberger (B Sc (Hons)),
- Alan Richardson (B Env Sc (Hons)),
- Maya Beretta (B Env Sc)
- Steve Roderick and
- Craig Anderson (B App Sc (EAM))

1.5.2 Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence S10300 (Valid 30 November 2009);
- Animal Research Authority (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2009);
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 01/1142) issued by NSW Agriculture (Valid 12 March 2010); and
- Certificate of Accreditation of a Corporation as an Animal Research Establishment (Trim File No: 01/1522 & Ref No: AW2001/014) issued by NSW Agriculture (Valid 26 May 2009).

1.5.3 Certification

As the principal author, I, Maya Beretta make the following certification:

- The results presented in the report are, in the opinion of the principal author and certifier, a true and accurate account of the species recorded, or considered likely to occur within the site;

- All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the *Animal Research Act 1995, National Parks and Wildlife Act 1974* and the *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes*.

Signature of Principal Author and Certifier:

Maya Beretta
Ecologist
RPS Harper Somers O'Sullivan
February 2009

2 VEGETATION MANAGEMENT

2.1 Vegetation Mapping

Flora surveys and vegetation mapping carried out on the site as a part of efforts by RPS HSO (Nov 2007) has been undertaken as follows:

- Aerial Photograph Interpretation (API) to map the community(s) extent into definable map units;
- Confirmation of the community type(s) present (dominant species) via the undertaking of detailed flora surveys and identification;
- Review of previous environmental studies conducted by Wildthing (2003a, 2003b, 2004a, 2004b, 2004c), Ecobiological (2006a, 2006b), and RPS HSO (2007);
- Review of the Natural Vegetation of the Wyong Local Government Area, Central Coast, New South Wales (Bell 2002);
- Review of the Lower Hunter and Central Coast Regional Environmental Management Strategy (LHCCREMS) Vegetation Mapping (NPWS 2000: House 2003) for the site and surrounding areas;
- The conservation status of the derived vegetation communities was considered in light of the findings of the LHCCREMS Vegetation Mapping (2003). Assessment of the potential for the derived vegetation communities to constitute EEC's as listed within the *TSC Act (1995*) and the *EPBC Act (1999)* was also undertaken. The floristic composition, geomorphological characters and geographic distribution were considered when determining whether an EEC was present.
- Flora surveys were carried out across the areas of the site that had not been previously surveyed, with an emphasis on potentially significant species, as outlined below. The general flora survey also included 17 20m x 20m quadrats and one 10m x 40m quadrat throughout the native vegetation within the site (Figure 2-2), as well as Random Meanders in line with methodology termed as the "Random Meander Technique" by Cropper (1993).

The literature review indicated that portions of the site were not covered by previous vegetation mapping. Broadscale vegetation mapping was undertaken by RPS HSO Ecologists within portions of the site that were not previously surveyed to ensure a complete vegetation map of the lands could be produced.

A vegetation map was created for the entire site by combining mapping undertaken previously by Wildthing (2003a, 2003b, 2004a, 2004b, 2004c,) and EcoBiological (2006a, 2006b) with broadscale mapping undertaken recently by RPS HSO Ecologists in areas not previously surveyed. This map is available in RPS HSO's Ecological Assessment Report (2007).

In January 2009, RPS HSO ecologists undertook a site inspection to locate and define the area of Littoral Rainforest identified in previous mapping by Ecobiological (2006a, 2006b). The vegetation type, which classifies as an EEC under the *TSC Act 1995*, was located and the boundary mapped using a GPS. Figure 2-1 illustrates the vegetation mapped by RPS HSO within the Catherine Hill Bay site while Figure 2-2, illustrates the location of the Littoral rainforest mapped by RPS HSO.

WARNING

No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from Harper Somers O'Sullivan Pty Ltd.

Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries 'on the ground'.

LEGEND

Vegetation Communities

- Dams
- Coastal Clay Heath
- Coastal Sand Scrub
- Narrabeen Wallarah Sheltered Grassy Forest
- Freshwater Wetland Complex
- Coastal Sand Wallum Woodland-Heath
- Regenerating Vegetation
- Swamp Mahogany - Paperbark Forest
- Coastal Plains Smooth-barked Apple Woodland
- Coastal Plains Scribbly Gum Woodland
- Weeds and Cleared Areas
- Regenerating Vegetation
- Apple-Palm Gully Forest
- Swamp Oak Rushland Forest
- Narrabeen Foreshore Redgum-Ironbark Forest
- Mangrove-Estuarine Complex
- Littoral Rainforest
- Drainage Lines

0 0.5 1km

TITLE: Figure 2-1 Vegetation Communities at CHB

CLIENT: Rosegroup Pty Ltd

SCALE: 1: 12000 at A3 Size **DRAWN:** Maya Beretta **APPROVED:** M. Doherty

DATUM: MGA Zone 56 (GDA 94) **DATE:** 8/1/2009

LAYOUT REF: J:\JOBS\24k\24619 - Gwandalan\Drafting\Mapinfo\Workspaces 24619 FIGURE 2-1 Veg Map 070109

CONTOUR INTERVAL: N/A

JOB REF: 24619

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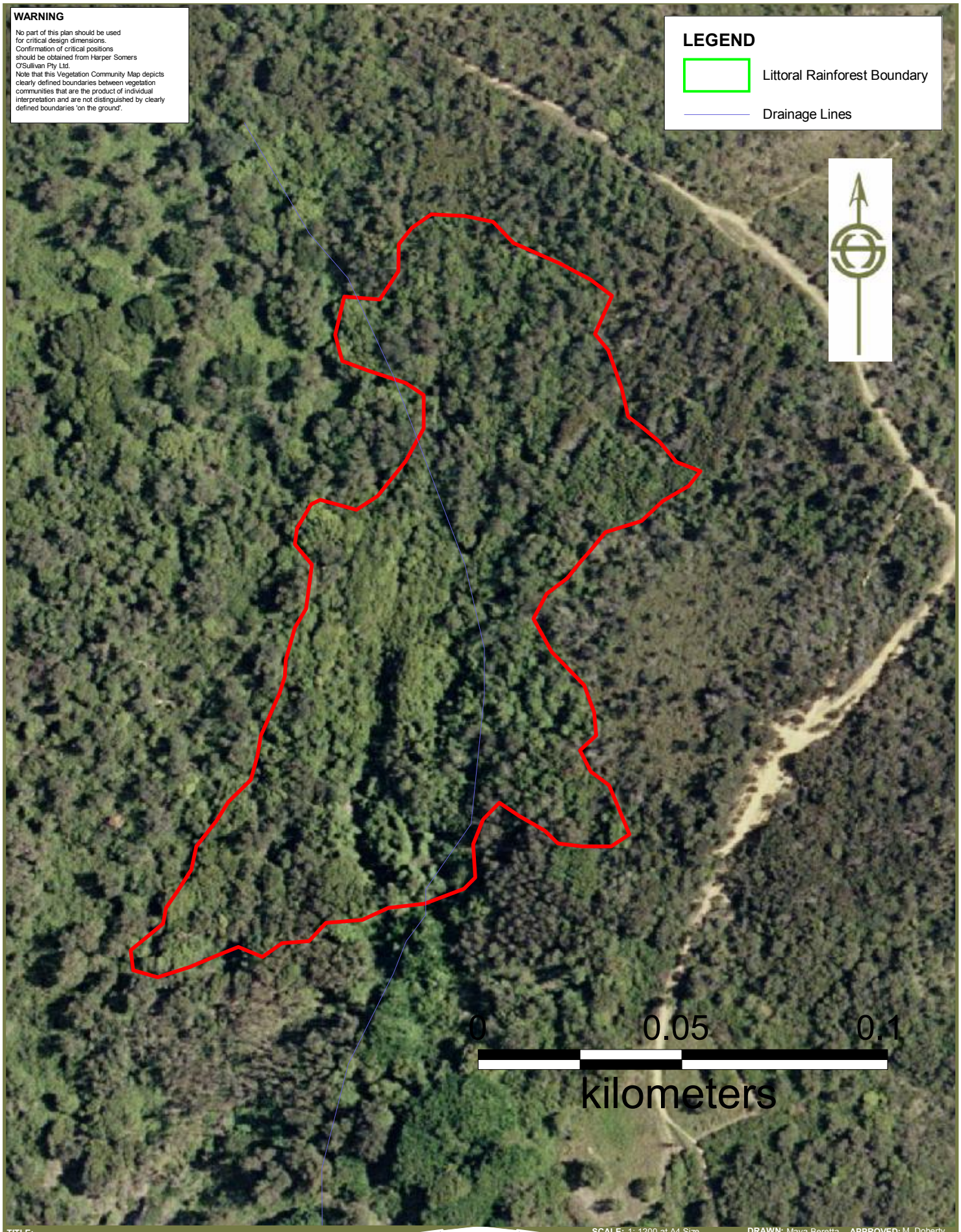
PLANNING SURVEYING ECOLOGY

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858



TITLE:
Figure 2-2 Littoral Rainforest

CLIENT:
Rosegroup Pty Ltd

PLANNING SURVEYING ECOLOGY

SCALE: 1: 1200 at A4 Size
DRAWN: Maya Beretta APPROVED: M. Doherty
DATUM: MGA Zone 56 (GDA 94) DATE: 7/1/2009
LAYOUT REF:
CONTOUR INTERVAL: N/A
JOB REF: 24619

HARPER SOMERS O'SULLIVAN
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

2.1.1 Littoral Rainforest

This vegetation community was located in the slopes and gullies within the site and covers an area of approximately 0.4ha. A total area of 1.17 ha of rainforest was mapped, the majority of which lies outside the bounds of the site. This community is commensurate with MU 4 Littoral Rainforest as described by LHCCREMS (NPWS 2000; House 2003) and classifies as the Littoral Rainforest EEC. Structurally this community is quiet patchy with areas where the dense canopy and vines restrict any lower stratum growth and areas which are highly disturbed (predominantly to the south of the community) where there are few vines and the canopy is more open allowing the groundcover to develop.

<u>*Upper Stratum*</u> – 4 to 6m with a Percent Foliage Cover (PFC) of 80 to 90%, the dominant species being *Synoum glandulosum* (Scentless Rosewood), *Glochidion ferdinandi* (Cheese Tree) and *Acmena smithii* (Lilly Pilly). The occasional *Banksia integrifolia* (Coast Banksia) was emergent from the canopy.

<u>*Vines*</u> – part of the canopy stratum, the dominant species being *Smilax glyciphylla* (Sweet Sarsaparilla), *Morinda jasminoides* (Sweet Morinda), *Marsdenia rostratula* (Milk Vine), *Cissus antartica* (Water Vine) and *Stephania japonica* (Snake Vine).

<u>*Mid Stratum*</u> – 2 to 4m with a PFC of 40 to 70%, was located predominantly along the edges of the rainforest and included regenerating canopy species and *Breynia oblongifolia* (Coffee Bush). A dense thicket of *Lantana camara* (Lantana) and *Chrysanthemoides monilifera ssp. rotunda* (Bitou Bush) occurred in patches on the edge of the rainforest community as well.

<u>*Lower Stratum*</u> – to 0.5m with a PFC of approximately 2 to 5%, the dominant species being *Adianthum aethiopicum* (Common Maidenhair) and *Viola hederacea* (Ivy-leaved Violet).

The remnant Littoral Rainforest which exists within the Rosegroup lands at Catherine Hill Bay does not occur within lands to be developed. A list of flora species recorded within the Littoral Rainforest is in Appendix B.

2.2 Landscaping and Revegetation.

The development lands will be landscaped following completion of the proposed development. Species selection for the landscaping works and seed stock for revegetation should be limited to locally occurring native species which will maintain the local genetic diversity. Species which should be included within landscaping and revegetation works should include;

- *Eucalyptus robusta* (Swamp Mahogany);
- *Allocasuarina littoralis* (Black She-oak);
- *Casuarina glauca* (Swamp She-oak);
- Any of the *Acacia* species recorded on site; and
- Any of the *Banksia* species recorded on site.

The *Eucalyptus robusta* is an important winter feed tree for several threatened birds. The *Allocasuarina littoralis* and *Casuarina glauca* are important feed plants for the Glossy Black Cockatoo and other threatened birds. The inclusion of a variety of shrubs such as Banksias and Acacias will ensure food sources in the form of pollen, seeds and foliage is available for a variety of native fauna inhabiting the locality.

Landscaping of sediment detention ponds should be undertaken with locally indigenous wetlands vegetation to provide habitat for wetlands species such as the threatened *Litoria aurea* (Green and Golden Bell Frog). Such vegetation should include *Typha orientalis* (Broadleaf Cumbungi) and *Lomandra longifolia* (Spiny Mat Rush).

2.3 Weed Management

Weed management and monitoring is recommended for the Catherine Hill Bay site to minimise the potential for the invasion of aquatic and terrestrial weed species into the nearby SEPP 14 Wetland and buffer zones. Such a plan should be developed in consultation with the DECC to ensure consistency with the management strategies used in the adjacent Munmorah SCA and the offset lands which are to be transferred to the DECC. The development of a Weed Management Plan for Catherine Hill Bay is recommended and should include;

1. **Weed removal**.

    a. Weeding direction on the site - working from areas with native plants towards weed-infested areas.

    b. Let native plant regeneration dictate the rate of weed removal. The site may need several visits over a period of months or even a year or more to remove weeds that are competing with regenerating native plants. Weed regeneration on weeded sites can be an issue for a period of years until the native plants are established; established native plants shade the soil and reduce ability for weeds to regenerate.

    c. Particular care should be taken when removing weeds from creek lines, as large amounts of exposed soil caused by weed removal could result in serious damage to creek banks during rain events. Complete removal of large areas of weeds such as Lantana and Privet would result in a loss of habitat for many small birds. Removal should be a gradual process allowing time for native vegetation to regenerate to sufficient density to be used as habitat.

    d. Weed removal is specific for individual weeds.

    Lantana

    - Small to medium sized Lantana plants can be pulled out by hand (care should be taken to remove <u>all</u> of the roots).

    – Large Lantana plants are removed by hacking into the centre of the plant and taking out the crown (the base of the plant and start of the root system) - cut as close to the roots as possible and paint the cut stem with Roundup. Also cut and paint with

Roundup or remove all roots of the sections of stem which have layered (stems where roots have developed).

- Lantana that has climbed up into trees and is entwined with the tree branches, can be cut and the long canes separated from the main plant, leaving them to rot. It may look untidy but pulling them out can damage the tree.

Privet

- Privet removal varies from drilling trees to injecting herbicide, cutting and painting with herbicide, spraying or hand pulling out (care must be taken to remove all the root system).

Bitou Bush

- Bitou Bush removal varies, it can be pulled out by hand (care should be taken to remove all of the roots) and also the roots on the stem which have layered. Follow up weeding is essential, as Bitou Bush seeds can remain viable in the soil for several years.

- Roundup can be used by cutting as close to the roots as possible and painting the cut stem with Roundup. Also cut and paint with Roundup or remove all roots on the sections of stem which have layered (stems where roots have developed).

2. Rapid **re-establishment of native vegetation** to reduce weed re-infestation, increase soil stabilisation and increase fauna habitat (birds / lizards / frogs / etc).

   As soon as possible after the primary weeding of the site, some planting of native trees and shrubs may be undertaken. Native plants for this site can be accessed through TIN and/or Landcare, also planting techniques / plant guards / spacing of your seedlings plants on the site / seasons for planting should be clarified from TIN or Landcare before you plant the trees and shrubs.

   In the first year of plant establishment some watering may be needed, but the aim is to produce a system which can cope with local conditions.

   Mulches are an effective method of controlling soil conditions (water loss, temperature and weed invasion). Mulches can be inexpensive such as ten sheets of newspaper, hay, straw or a combination such as newspaper with hay on top.

3. Consistent **monitoring of sites** that have been worked on, to enable the increase of native plant regeneration and decrease the weed regeneration on these sites.

2.4 Threatened Flora

Two threatened flora species, *Tetratheca juncea* (Black-eyed Susan) and *Cryptostylis hunteriana* (Leafless Tongue Orchid) have been recorded within the development lands of Catherine Hill Bay. Populations of both of these species have also been recorded in the offset lands.

A Plan of Management (POM) has been prepared for *T. juncea* within the Catherine Hill Bay site and is attached in Appendix C.

Another POM should be prepared focusing on the management of *C. hunteriana* to ensure the conservation and long-term survival of this threatened orchid from the development of the site. Such a POM should include measures such as a recommended buffer surrounding individual clumps (suggested 50m) to protect the species from development impacts as well as an identification of the threats to this species and ways to mitigate against such threats.

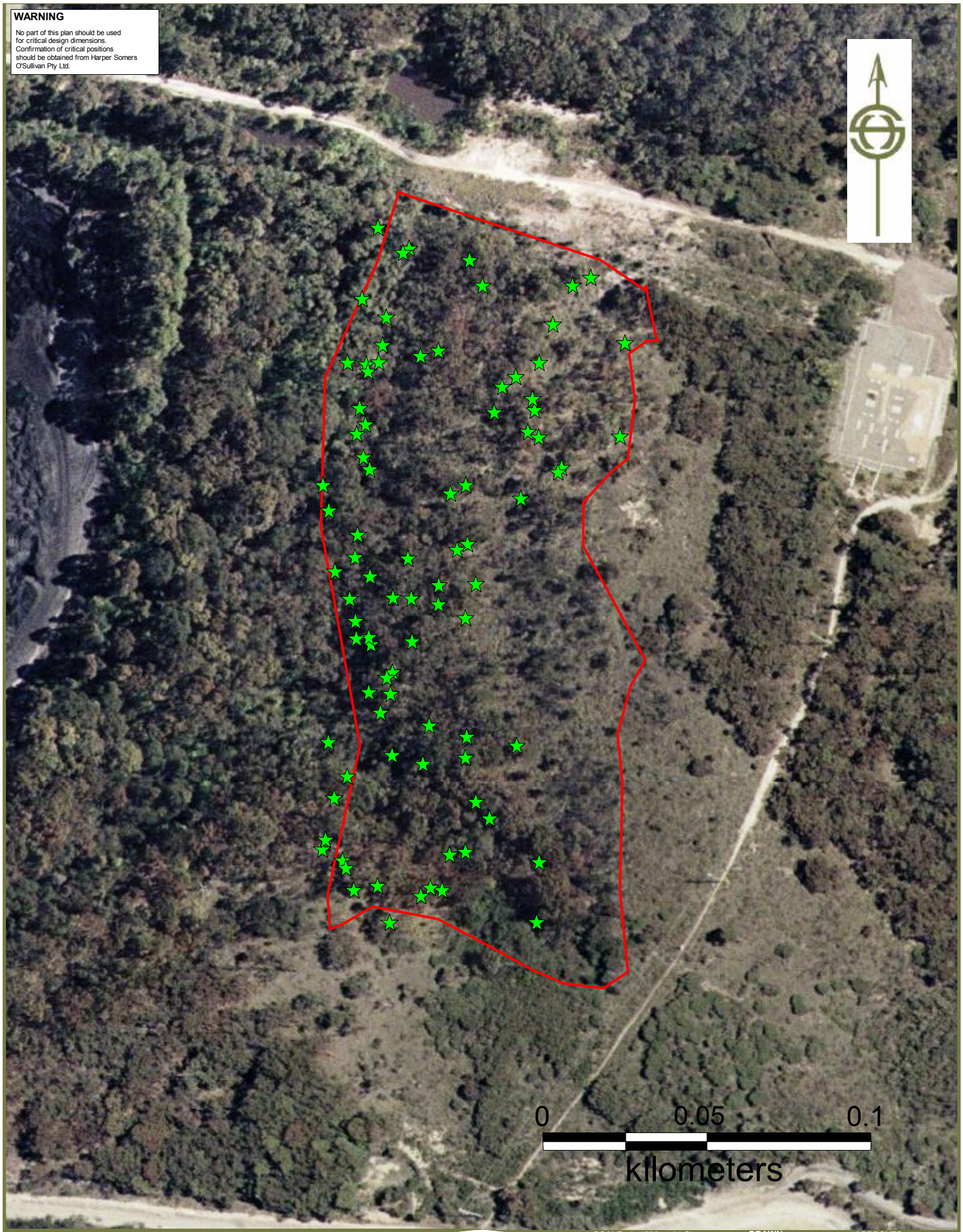
3 FAUNA MANAGEMENT

3.1.1 Native Species Habitat – Mature and Hollow Bearing Trees

Mature and hollow bearing trees were mapped in development Hamlet 6 using a GPS by RPS HSO ecologists on the 6th of January 2009. A total of 70 mature trees were recorded in Hamlet 6. Mature trees are defined as those trees which have a diameter at breast height of 50cm or more.

A total of 45 trees or stags (dead trees) contained 1 or more hollows with an entrance diameter of between 2 and 10cm. 25 trees or stags contained hollows with an entrance diameter of between 11 and 20cm while 3 contained hollows with an entrance diameter of over 20cm. Tree hollows are an important resource for hollow dependant native fauna as historical clearing for urbanisation has lead to a marked decline in the number of available hollows. Tree hollows that have an entrance diameter of between 2 and 10cm may be used for roosting or nesting by a variety of native fauna such as microchipteran bats, small parrots and small marsupials such as sugar gliders. Tree hollows with entrance diameters of between 11 and 20cm are used for nesting and roosting by larger marsupials such as Brush-tailed Possums while hollows with entrance diameters over 20cm are utilised by forest owls, such as Powerful Owls, and large parrots such as Black Cockatoos for nesting (Lindenmayer et al, 2004).

Figure 3-1 illustrates the location of the mature and hollow bearing trees observed within Hamlet 6.



TITLE:
Figure 3-1 Mature and Hollow Bearing Trees in Hamlet 6

CLIENT: Rosegroup Pty Ltd

SCALE: 1: 1500 at A4 Size
DRAWN: Maya Beretta
APPROVED: M. Doherty
DATUM: MGA Zone 56 (GDA 94)
DATE: 7/1/2009
LAYOUT REF:
CONTOUR INTERVAL: N/A
JOB REF: 24619

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

3.2 Threatened and Migratory Species Management

3.2.1 Masked Owl

The Masked Owl has been recorded (DECC Wildlife Atlas) within 5km of the subject site and within the subject site during previous investigations (Wildthing, 2003a). While RPS HSO ecologists did not find evidence of Masked Owl breeding within the subject site, suitable breeding habitat does exist and further investigations of breeding activity is strongly recommended. Such targeted Masked Owl surveys should be undertaken prior to any vegetation removal and should include stagwatching of potential roosts, spotlighting and call playback.

Should the Masked Owl be detected breeding within the subject site, measures that should be undertaken to minimise the impacts of the proposal on this species include:

- Delaying vegetation removal until young Masked Owls have fledged; and
- When young have fledged and the nest is no longer being used, vegetation should be cleared within 3 months to prevent nesting re-occurring within the tree concerned.

3.2.2 Glossy Black Cockatoo

The high concentrations of Glossy Black-Cockatoo chewed cones observed within Gwandalan development lands in August 2007 and the high abundance of potential nesting hollows may indicate that the species may breed within the Gwandalan development lands. Targeted searches for Glossy Black-Cockatoo nesting sites within the Gwandalan development lands should be undertaken during the appropriate season (March to August) prior to vegetation removal (ie during March - August in the same year as vegetation removal is proposed). Multiple visits would be required during this survey period to assess whether the species breeds within the site.

In the case that Glossy Black Cockatoo is found to be breeding within the Gwandalan development lands:

- Vegetation removal should not commence until young have fledged. This may require ongoing monitoring by experienced ecologists.
- Once the nest is no longer being used, vegetation clearance may occur. Vegetation removal should not occur within the breeding period (March-August).

3.2.3 White-bellied Sea Eagle

An active White-belled Sea Eagle nest was located in the offset lands. These coastal birds form sedentary pairs whose young disperse away from the nest (Morecombe, 2000) which is used for many breeding seasons in succession (Olsen et al, 1993). The White-bellied Sea Eagle is protected under the Commonwealth *Environmental Protection and Biodiversity Conservation Act* 1999 (EPBC), China Australia Migratory Birds Agreement (CAMBA) and it's breeding habitat must, therefore, be protected in accordance with such legislation.

This species is under threat from (Department of Sustainability and Environment, 2003);

- Poisoning during baiting for feral animals such as foxes;
- Secondary poisoning during feral rabbit control programs;
- Illegal shooting;
- Habitat loss to encroaching urban development and
- Detrimental impacts to the breeding and young rearing process by human disturbance.

To protect these rare raptors, disturbance to the nest site should be kept to a minimum by ensuring that bushwalking tracks, fire tracks and general disturbance is kept a safe distance from the nest. This is important as the species has been known to desert their nests and young if disturbed by humans (Department of Sustainability and Environment, 2003). The Parks and Wildlife Service of Tasmania (Aug, 2003) suggest a buffer of 250m be retained around active nests within which no development or disturbance is permitted.

4 GENERAL ENVIRONMENTAL ISSUES

4.1 SEPP 14 Wetland

A SEPP 14 Coastal Wetland, which is defined as an Endangered Ecological Community (Freshwater Wetlands on Coastal Floodplains), is located south of the Catherine Hill Bay development lands and is known habitat for *Crinia tinnula* (Wallum Froglet). The proposal has the potential to impact upon the Coastal Wetland habitat through changed water flow regimes and sediment loads. To minimise potential impacts on the fragile Coastal Wetland habitat, the following measures should be implemented;

- Strict management of stormwater runoff from the development lands;
- Nutrient and sediment control devices must be erected pre-clearing and post construction in sensitive areas where degradation processes may be triggered. Such locations include adjacent to watercourses and drainage lines until suitable rehabilitation has occurred to maintain the stability of the surface. Stockpiles should be subject to individual sediment and nutrient control devices;
- Wetland vegetation must be protected by a 50m buffer within which no landuse that may impact upon the potential of the buffer to protect wetland vegetation should be permitted. This buffer should consist of fringing vegetation but where no vegetation exists, the area should be revegetated with appropriate species such as plants from the genus of *Melaleuca* (Paperbarks), *Leptospermum* (Tea-Trees), *Gahnia* (Sedges), *Dianella* (Flax Lilies) and *Lomandra* (Mat-Rushes); and
- If these buffers are unable to be implemented, additional control measures should be investigated in consultation with experienced wetland hydrogeologists and engineers to ensure that potential impacts are minimised.

4.2 Vegetation Clearing Minimisation Principals

The minimum amount of vegetation clearing should take place as a general objective of the project, especially in vegetation which is consistent with EECs. To meet this general objective, trees which do not have to be cleared for construction should be retained whenever possible. Vegetation Clearing Minimisation and impact Minimisation principals include;

- Lopping of branches to facilitate construction without the need to remove vegetation;
- Retention of vegetation wherever possible along drainage lines to prevent increased erosion and sedimentation while also maintaining existing fauna corridors and food resources;
- Mature and / or hollow-bearing trees should be retained wherever feasible and with regards to public safety within the development framework, particularly within Gwandalan development lands where there are no offsets immediately adjacent to the site;

- Pre-clearing inspections should be undertaken by an ecologist in wooded areas where threatened fauna species have been recorded or are considered likely to occur. This is particularly important in areas where threatened fauna have been noted during recent surveys either breeding or nest-building. No breeding attempts should be disrupted during the course of the project, particularly by threatened fauna;

- During the construction phase, for any tree removal within forested areas, and in particular where hollow-bearing trees may be removed, all works should be supervised by an ecologist to recover any native fauna that are potentially displaced. Furthermore, where such risks occur, site-specific ecological advice should be sought to minimise impacts during the entire process. A clearing protocol should be adopted for the removal of trees containing suitable habitat hollows as follows (this is considered as a guideline, variations on the methods employed may be required to accommodate site specific factors):

    - All hollow bearing trees are to be flagged by an ecologist prior to the commencement of works on site.

    - Underscrubbing of the entire site should be carried out by a 4x4 tractor with a slashing deck, this will minimise the establishment of degradation processes and leave a layer of mulch to aid in soil retention in the event of adverse weather. At this time felling of non habitat trees can take place, however a matrix of trees *must* be maintained to allow animal movement into the designated refuge area.

    - After a period of two weeks, clearing of habitat trees should commence. Clearing must be carried out moving from the fringe of the matrix towards the refuge area. Trees should be 'soft felled' and inspected immediately by an ecologist for displaced fauna. All trees must be left for a minimum of two nights prior to being moved to a stockpile, to allow resident fauna to vacate tree hollows.

  Note: Clearing should ideally take place outside of the main breeding seasons of resident fauna, preferably during late Autumn and Winter.

4.3 Erosion and Sediment Control

In order to prevent a significant increase in erosion and protect off site areas from increased sedimentation, appropriate erosion and sediment control works are required. This will help to maintain existing off site habitat characteristics for native fauna including threatened species. Such control mechanisms include;

- Where possible, earthworks (and definitely any earthworks in the vicinity of drainage lines) should be undertaken during dry weather conditions to ensure that potential erosion events will not result in significant downstream impacts;

- Strict management of stormwater runoff from the development lands; and

- Nutrient and sediment control devices must be erected pre-clearing and post construction in sensitive areas where degradation processes may be triggered. Such locations include adjacent to watercourses and drainage lines until suitable rehabilitation has occurred to maintain the stability of the surface. Stockpiles should be subject to individual sediment and nutrient control devices.

5 CONCLUSIONS

Recommended clearing procedures, nutrient and sediment control practices will protect adjacent vegetation and flowlines including vital SEPP 14 Wetlands and EECs. Adhering to clearing procedures as pertains to wildlife breeding and fledging will protect local fauna including the White-bellied Sea Eagle, whose habitat will be enhanced post development through the use of locally indigenous plants in landscaping works.

Therefore, it has been concluded that should all the measures addressed within this Environmental Management Plan be instigated, then the integrity and ecological values of the subject site can be maintained in the long term.

6 REFERENCES

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Wildthing Environmental Consultants (2004a) *Statement of Effect on Threatened Flora and Fauna for the proposed development of Part Lot 2 DP 809795, Catherine Hill Bay, NSW, February 2004*, Coastal Hamlets Pty Ltd.

Wildthing Environmental Consultants (2004b) *Statement of Effect on Threatened Flora and Fauna for the proposed development of Part Lot 2031 DP 841175, Catherine Hill Bay, NSW, February 2004*, Coastal Hamlets Pty Ltd.

Wildthing Environmental Consultants (2004c) *Statement of Effect on Threatened Flora and Fauna for the proposed development of Part Lot 5 DP 774923 and Part Lot 2031 DP 841175, Catherine Hill Bay, NSW, July 2004*, Coastal Hamlets Pty Ltd.

APPENDIX A MOU

THE MINISTER FOR THE ENVIRONMENT

and

THE MINISTER FOR PLANNING

and

COASTAL HAMLETS PTY LTD

and

LAKESIDE LIVING PTY LTD

MEMORANDUM OF UNDERSTANDING

I V KNIGHT
Crown Solicitor
60-70 Elizabeth Street
SYDNEY NSW 2000

200600938 D2006/178441

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MEMORANDUM OF UNDERSTANDING

THIS MOU is made on 16TH of October 2006.

Between

1. **THE MINISTER FOR THE ENVIRONMENT** of Level 36, Governor Macquarie Tower, 1 Farrer Place, Sydney in the State of New South Wales; and

2. **THE MINISTER FOR PLANNING** of Level 34, Governor Macquarie Tower, 1 Farrer Place, Sydney in the State of New South Wales

   (together, the "Government"); and

3. **Coastal Hamlets PTY LTD** ACN 100 126 994 (the "CHB Landholder").of 51 Riley St, Woolloomooloo, NSW 2011, a Rosecorp group company; and

4. **Lakeside Living Pty Ltd** ACN 054 400 814 (the "Gwandalan Landholder") of 51 Riley St, Woolloomooloo, NSW 2011, a Rosecorp group company.

Background

A. The New South Wales Government intends to implement an Environmental Land Offset Scheme for the Lower Hunter region to complement and support the Lower Hunter Regional Strategy and the Lower Hunter Regional Conservation Plan.

B. The Environmental Land Offset Scheme aims to:

   (i) increase public ownership of certain land in the Lower Hunter region for dedication as a conservation reserve; and

   (ii) recognise the development potential of certain other land in the Lower Hunter region.

C. The purpose of this MOU is to set out the parties' intentions with respect to the implementation of the Environmental Land Offset Scheme, insofar as it concerns the Landholder.

1. Definitions and interpretation

1.1 In this MOU, unless the context otherwise requires:

"**Conservation reserve**" means any land intended to be reserved or dedicated under the *NPW Act* and includes references to a national park, nature reserve, state conservation area or regional park, as those terms are defined under that Act

"**Development potential of Schedule 1 land**" means the development potential specified in Schedule 1 for each parcel of Schedule 1 land (either hectares or dwellings or both).

"**Dwelling**" has the same meaning as in the *Standard Instrument—Principal Local Environmental Plan.*

"**Environmental Land Offset Scheme**" insofar as it concerns the Landholder means the Environmental Land Offset Scheme described in clause 3 of this MOU.

"**EP&A Act**" means the *Environmental Planning and Assessment Act 1979*, as amended from time to time.

"**Lower Hunter Regional Conservation Plan**" means the Lower Hunter Regional Conservation plan released by the NSW Department of Environment and Conservation, published on that Department's website and as amended from time to time.

"**Lower Hunter Regional Strategy**" means the Lower Hunter Regional Strategy released by the NSW Department of Planning, published on that Department's website and as amended from time to time.

"**Map**" means the untitled map identifying the Coastal Hamlets Pty Ltd holdings in Catherine Hill Bay that is incorporated into this MOU by reference.

"**MOU**" means this Memorandum of Understanding which includes the Schedules and map that are incorporated into this MOU by reference

"**NPW Act**" means the *National Parks and Wildlife Act 1974* as amended from time to time.

"**Rezoning**" means the mechanism of changing the landuse zone for a parcel of land contained in a environmental planning instrument (as defined by the the EP&A Act), noting that this change in landuse zone may be effected by the gazettal of a State Environmental Planning Policy or a local environmental plan.

"**Schedule 1 land**" means the parcels of land owned by the CHB Landholder and the Gwandalan Landholder, referred to in the Lower Hunter Regional Strategy and identified in Schedule 1, or part thereof.

"**Schedule 2 land**" means the parcels of land owned by the CHB Landholder and identified in Schedule 2, or part thereof.

"**TSC Act**" means the *Threatened Species Conservation Act 1995* as amended from time to time.

"Transferred Schedule 2 land" means Schedule 2 land, or part thereof, transferred to the Minister for the Environment in accordance with clause 3.2.

"Wyong Residential Development Strategy" means the Wyong Residential Development Strategy released by Wyong Shire Council in December 2002 and published on the Council's website.

2. Implementation

2.1 The parties are committed to using their best endeavours to implement this MOU.

2.2 The parties acknowledge and agree that:

(a) this MOU is intended to express the parties' objectives and firm intentions with regard to those matters with which it deals, but is not intended to create enforceable or binding legal obligations between them;

(b) nothing in this MOU shall be taken to fetter the discretion of the Minister for Planning in exercising functions under the *EP&A Act* or the Minister for the Environment in exercising functions under the NPW Act or the TSC Act; and

(c) nothing in this MOU is intended to constitute a representation, warranty or guarantee by or on behalf of the Government, the Minister for Planning or the Minister for the Environment.

2.3 All parties acknowledge and agree that they have not relied or acted or forborne from acting in any way as a result of any statement made by any of the parties in this MOU or in discussions leading up to this MOU.

3. The Environmental Land Offset Scheme

3.1 The Landholder intends to develop land identified in the Lower Hunter Regional Strategy by preparing a Rezoning application as soon as practicable and at least within 5 years that is consistent with the development potential of Schedule 1 land.

3.2 The Minister for Planning intends to use reasonable endeavours to allow the Landholder to achieve the development potential of Schedule 1 land by either:

(a) Rezoning the land through an amendment to State Environmental Planning Policy 2005 (Major Projects) and approval of any concept plan submitted under Part 3A of the EP&A Act; and/or

(b) Facilitating the rezoning of the land through the gazettal of a Local Environmental Plan prepared by the relevant local government authority and made by the Minister for Planning and approval of any concept plan submitted under Part 3A of the EP&A Act ; and/or

(c) Any other means that achieves or encourages the more intensive use of the land;

in accordance with the Lower Hunter Regional Strategy, the Lower Hunter Regional Conservation Plan and subject to the requirements of the *EP&A Act*.

3.3 The Landholder intends to transfer ownership of Schedule 2 land to the Minister for the Environment upon the rezoning of Schedule 1 land.

3.4 The Minister for the Environment intends to ensure Transferred Schedule 2 land is dedicated as part of the national park estate or as a conservation reserve.

3.5 The Landholder intends not to undertake any action or activity, pending transfer of Schedule 2 land or rezoning of Schedule 1 land that will have detrimental effect on the conservation or Aboriginal heritage values of Schedule 2 lands except where the Landholder is

(a) directed to undertake such an action or activity by another Government agency or instrumentality (such as the Rural Fire Service and the NSW Department of Primary Industries), or

(b) is otherwise required by law to undertake such an action or activity.

4. Agreement

4.1 Notwithstanding clause 3, the details of the Environmental Land Offset Scheme described in clause 3 are the subject of ongoing negotiation by the parties, which they propose will form part of a legally enforceable agreement to be entered into by them.

4.2 All parties are to use their best endeavours to enter into such an agreement referred to in clause 4.1 as soon as possible noting a target date of three months for this to occur.

4.3 The parties acknowledge that the proposed agreement referred to in clause 4.1 will include a schedule of commitments that set out the sequencing and staging of Schedule 1 land and the dedication for conservation of Schedule 2 lands.

4.4 The parties acknowledge that:

(a) If there is any reduction in Schedule 2 Land to be transferred then a proportional reduction will result for the development potential of the Catherine Hill Bay Schedule 1 Land

(b) If the development potential of the Catherine Hill Bay Schedule 1 Land in relation to the number of dwellings or lots to be achieved is reduced then a proportional reduction will occur in the amount of Schedule 2 Land to be transferred to the Minister for the Environment

5. Term

5.1 This MOU starts on the date it is signed by both parties and continues until the parties enter into an agreement of the type referred to in clause 4, or 5 years, whichever is the later.

This Memorandum of Understanding is signed on 16TH October 2006.

The Honourable Bob Debus MP
The Minister for the Environment

The Honourable Frank Sartor MP
The Minister for Planning

Bryan Rose, Director, for and on behalf of
Coastal Hamlets Pty Ltd

Bryan Rose, Director, for and on behalf of
Lakeside Living Pty Ltd

SCHEDULE 1 – POTENTIAL DEVELOPMENT LANDS

This Schedule forms part of the MOU.

Schedule 1 Land

Property description	Map reference	Development potential
	Catherine Hill Bay – lands shaded green	• Residential development covering up to 60 hectares to achieve 600 dwellings
	Gwandalan – identified as Precinct 1A in the Wyong Residential Development Strategy	Residential development over 26 hectares to achieve 12 dwellings per hectare as proposed in the Residential Development Strategy

SCHEDULE 2 – ENVIRONMENTAL LANDS OFFSETS

This Schedule forms part of the MOU.

Schedule 2 Land

Property description	Map reference	Area
	Catherine Hill Bay and Wallarah Peninsula – Coastal Hamlets Pty Ltd lands within the white outline and not shaded green	Approximately 310 hectares

APPENDIX B Littoral Rainforest Flora Species List

Authorities for the scientific names are not provided in the list. These follow the references outlined below.

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Introduced species are indicated by an asterisk "*".

Class/Subclass	Family	Scientific Name	Common Name
Filicopsida	Adiantaceae	*Adiantum aethiopicum*	Common Maidenhair
Magnoliidae	Apocynaceae	*Parsonsia straminea*	Common Silkpod
Magnoliidae	Araliaceae	*Polyscias sambucifolia*	Elderberry Panax
Magnoliidae	Asclepiadaceae	*Marsdenia rostrata*	Common Milk Vine
Magnoliidae	Asteraceae	*Bidens pilosa**	Cobbler's Pegs
Magnoliidae	Asteraceae	*Chrysanthemoides monilifera ssp. rotundata**	Boneseed
Magnoliidae	Bignoniaceae	*Pandorea pandorana*	Wonga Vine
Magnoliidae	Convolvulaceae	*Ipomoea indica**	Coastal Morning Glory
Magnoliidae	Eleocarpaceae	*Elaeocarpus reticulatus*	Blueberry Ash
Magnoliidae	Euphorbiaceae	*Breynia oblongifolia*	Coffee Bush
Magnoliidae	Euphorbiaceae	*Glochidion ferdinandii*	Cheese Tree
Magnoliidae	Eupomatiaceae	*Eupomatia laurina*	Bolwarra
Magnoliidae	Meliaceae	*Synoum glandulosum*	Scentless Rosewood
Magnoliidae	Menispermiaceae	*Stephania japonica var. discolor*	Snake Vine
Magnoliidae	Myrtaceae	*Acmena smithii*	Lillypilly
Magnoliidae	Ochnaceae	*Ochna serrulata**	Mickey Mouse Plant
Magnoliidae	Oleaceae	*Notelaea ovata*	Mock Olive
Magnoliidae	Rosaceae	*Rubus moluccanus*	Broad-leaf Bramble
Magnoliidae	Rubiaceae	*Morinda jasminoides*	-
Magnoliidae	Sapindaceae	*Cupaniopsis anacardioides*	Tuckeroo
Magnoliidae	Verbenaceae	*Lantana camara**	Lantana
Magnoliidae	Violaceae	*Viola hederacea*	Ivy-leaved Violet
Magnoliidae	Vitaceae	*Cissus antarctica*	Native Grape
Liliidae	Arecaceae	*Livistona australis*	Cabbage Tree Palm
Liliidae	Asparagaceae	*Protasparagus aethiopicus**	Asparagus Fern
Liliidae	Cyperaceae	*Carex appressa*	Tall Sedge
Liliidae	Smilacaceae	*Smilax australis*	Lawyer Vine
Liliidae	Smilacaceae	*Smilax glyciphylla*	Sarsaparilla

The following standard abbreviations are used to indicate subspecific taxa:

ssp. - subspecies
var.- variety
agg. Aggregate

APPENDIX C *Tetratheca juncea* Plan of Management

APPENDIX D Personnel Qualifications

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name: Toby Lambert

Office: RPS Harper Somers O'Sullivan

Position in Company: Senior Ecologist

Qualifications / Memberships:
Bachelor of Environmental Science
Ecological Consultants Association of NSW
NSW Driver's Licence (Class C)
OH&S Induction Training (Green Card)
NPWS Scientific Investigation Licence
NSW Animal Ethics Research Authority

Areas of Expertise:

- Environmental and ecological impact assessment reporting
- Flora, fauna and habitat survey methodology design and management
- Detailed understanding of threatened species legislation and issues
- Terrestrial fauna surveys
- Renewable energy assessment
- Bushland and vegetation management
- Complex holistic project management
- Local, State and Commonwealth project co-ordination
- Dispute resolution and mediation

Experience Includes:

Toby has over twelve years experience in undertaking and managing a diverse array of ecological and environmental surveys and assessments. Toby has produced ecological and environmental documentation for private and public projects ranging in complexity. These include a number of wind farms throughout Australia and New Zealand, coal mines and a range of infrastructure projects within the Hunter region. Toby has also managed ecological masterplanning for residential projects in Sydney, the Central Coast and the Hunter. Toby is also currently the project manager for the environmental component of the development of the Hunter Economic Zone industrial estate at Kurri Kurri, the largest industrial estate in NSW.

Toby's fields of special competence are Environmental Impact Assessment and mediation, flora, fauna and habitat survey method, design and identification, detailed understanding of legislation and threatened species issues, terrestrial fauna surveys and project management.

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name:	Deborah Landenberger
Office:	RPS Harper Somers O'Sullivan
Position in Company:	Ecologist/ Botanist
Qualifications / Awards	B. Sc (Hons – First Class) NSW Driver's Licence (Class C) OH&S Induction Training (Green Card) NPWS Scientific Investigation Licence NSW Animal Ethics Research Authority
Memberships:	Australian Plant Society Australian Network for Plant Conservation Australasian Native Orchid Society

Areas of Expertise:

- Flora identification and habitat assessment
- Targeted threatened flora surveys
- Delineation and mapping of vegetation communities
- Endangered Ecological Community (EEC) assessment
- Threatened Flora Management Plans
- Experience in PATN Statistical package
- Ecological Monitoring and Reporting
- Vegetation and Bushland Management Plans
- Project Management and quote preparation
- Experience with GPS/GIS for project design and mapping
- Detailed understanding of environmental legislation

Project Experience Includes:

Deborah Landenberger has broad range of Ecological Assessment reporting experience underpinned by over 10 years of ecological field experience. Experience within the consulting industry has primarily included a wide range of flora assessment disciplines as required by a wide range of public and private clients. Debbie has a strong grounding in threatened flora species ecology and vegetation mapping ranging from the South Coast of NSW to Guyra in the north west and Port Macquarie on the north coast of NSW.

Debbie's strong botanical interests have been central in a number of important projects, these include major vegetation mapping projects in the south of Lake Macquarie, Minmi to the west of Newcastle, Ben Lomond (near Guyra), Oberon, North Arm Cove, Singleton and Bulahdelah. Her knowledge of non-parametric statistics, such as PATN statistical program has enabled RPS HSO to undertake large mapping projects using sound scientific methodology. Her knowledge of threatened flora species includes 2 years research on the threatened flora species *Tetratheca juncea.* Debbie's wide ranging knowledge and experience of Australian flora is a vital part of RPS HSO's ability to meet the consultation and regulatory needs of the development community.

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name:	Maya Beretta
Office:	RPS Harper Somers O'Sullivan
Position in Company:	Ecologist
Qualifications / Awards	B. Env Sc NSW Driver's Licence (Class C) NPWS Scientific Investigation Licence Senior First Aid
Memberships:	Australasian Bat Society Australian Network for Plant Conservation

Areas of Expertise:

- Flora identification and vegetation survey
- Biodiversity survey and assessment
- Habitat assessment
- Endangered Ecological Community (EEC) assessment
- Ecological Monitoring and Reporting
- Property Vegetation Plans (PVP under the Native Vegetation Act, 2005)
- Experience with GPS/GIS for project design and mapping
- Detailed understanding of environmental legislation

Project Experience Includes:

Maya Beretta has broad range of Ecological Assessment reporting experience underpinned by 7 years of ecological field experience. Experience within the public sector has primarily included environmental impact assessment of vegetation clearance proposals as required by a wide range of public and private clients and biodiversity assessment of private conservation areas. Maya has attained Biodiversity Accreditation under the Native Vegetation Act 2005 and is experienced in the use of the Property Vegetation Plan Developer and associated tools.

Maya has a strong grounding in vegetation ecology and flora identification in the catchments of the Central West, Lachlan, Southern Rivers and Hawkesbury Nepean ranging from the Victorian boarder to Walgett in the north west of NSW. Maya has also been involved in fauna survey throughout the Central West and Far Western areas of NSW and has experience in trapping and identification of mammals and reptiles.

Tetratheca juncea Plan of Management

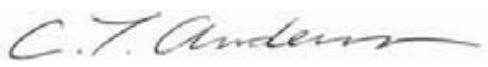
For the
Catherine Hill Bay Rosegroup Site

Prepared for
Rosegroup Pty Ltd
51 Reiley Street
Woolloomooloo NSW 2011

Job Reference 24619 - February 2009

HARPER SOMERS O'SULLIVAN
PLANNING · SURVEYING · ECOLOGY
A member of RPS Group Plc

Prepared By:
RPS Harper Somers O'Sullivan
PO Box 428
Hamilton NSW 2303
Tel: (02) 4961 6500
Fax: (02) 4961 6794
Web: www.rpshso.com.au

PROJECT: TETRATHECA JUNCEA PLAN OF MANAGEMENT – CATHERINE HILL BAY	
CLIENT:	*ROSEGROUP PTY LTD*
OUR REFERENCE:	*24619*
DATE:	*JANUARY 2009*
APPROVED BY:	*MAYA BERETTA*
SIGNATURE:	
CHECKED BY:	*CRAIG ANDERSON*
SIGNATURE:	

EXECUTIVE SUMMARY

INTRODUCTION

RPS HSO has been commissioned by Rosegroup to prepare a *Tetratheca juncea* Plan of Management (POM) for populations of this threatened plant that occur within the Rosegroup lands at Catherine Hill Bay, NSW.

Tetratheca juncea is listed as vulnerable on Schedule 2 of the *Threatened Species Conservation Act 1995* (*TSC Act 1995*) and as vulnerable under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act 1999*). This species is currently conserved in Glenrock, Lake Macquarie and Lake Munmorah State Recreation Areas, Awabakal Nature Reserve and Wallarah National Park. The majority of these reserves are along the eastern edge of the species range with no reserves within the central or western distribution (NPWS 2000).

This Plan aims to provide management strategies for the protection and ongoing maintenance for *Tetratheca juncea* populations both pre and post construction within the site. This plan can be used as a future management tool by the Community Body to ensure that residents are fully aware of the *Tetratheca juncea* populations within the site and can assist in the survival of *Tetratheca juncea* for the future. The scope of this POM is to;

- Protect the *Tetratheca juncea* population within the site from threatening processes such as weed incursions, littering, inappropriate fire regimes and disturbances from uncontrolled human interaction; and

- Maintain the existing habitat including fire regime, soil conditions, hydrological regime, flora species composition and vegetation cover within the site.

PROTECTION OF *TETRATHECA JUNCEA*

Populations of *Tetratheca juncea* in the past have been impacted upon by anthropogenic factors such as urban development, grazing, weed incursions and inappropriate fire regimes.

1. To ensure the survival of *T. juncea* within the conservation lands, the NSW NPWS, who manage several other areas containing this threatened plant, have taken over management of the conservation lands in accordance with the MOU and will manage the area for conservation in perpetuity.

CONCLUSIONS

It has been concluded that should all the measures addressed within this Plan of Management for *Tetratheca juncea* be instigated then the integrity and ecological value of the *Tetratheca juncea* populations can be maintained within the community land in the long term. Populations protected within the conservation lands will be managed by the NSW NPWS who are part of the DECC and are the State's leading government agency on threatened species and their management.

GLOSSARY OF TERMS

CHB – Catherine Hill Bay

DBH – Diameter at Breast Height

DCP – Development Control Plan

DECC – NSW Department of Environment and Climate Change (formerly NSW National Parks and Wildlife Service, NSW Department of Environment and Conservation)

DEWHA - Commonwealth Department of Environment, Water, Heritage and the Arts

EEC - Endangered Ecological Community

EP&A Act – NSW *Environmental Planning & Assessment Act 1979*

EPBC Act – Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

GPS – Global Positioning System

ha – hectare

LEP – Local Environmental Plan

LGA – Local Government Area

MOU – Memorandum of Understanding

POM – Plan of Management

ROTAP – Rare or Threatened Australian Plants listed by Briggs and Leigh (1996)

RPS HSO – RPS Harper Somers O'Sullivan

SCA – State Conservation Area

SF – State Forest

Site – the site subject to this Report

ssp. / subsp. – sub-species

TSC Act – NSW *Threatened Species Conservation Act 1995*

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FIGURES

APPENDICES

1 INTRODUCTION

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This Plan aims to provide management strategies for the protection and ongoing maintenance for *Tetratheca juncea* populations both pre and post construction within the site. This plan can be used as a future management tool by the Community Body to ensure that residents are fully aware of the *Tetratheca juncea* populations within the site and can assist in the survival of *Tetratheca juncea* for the future.

1.1 Background

A Memorandum of Understanding (MoU) covering the site was made on 16th October 2006 between the NSW Minister for the Environment, the NSW Minister for Planning, Coastal Hamlets Pty Ltd and Lakeside Living Pty Ltd (attached as Appendix A). Both Coastal Hamlets Pty Ltd and Lakeside Living Pty Ltd are Rosegroup companies. The MoU outlines the intention to implement an Environmental Lands Offset Scheme.

The proposal includes the development of up to 60ha of land at CHB and up to 26ha of land at Gwandalan and the provision of 310ha of land to conservation. The 310ha of land dedicated for conservation has been transferred to the DECC who will manage the land for conservation in perpetuity.

Previous ecological investigations have been undertaken over the past five years across various portions of the land covered by the MoU. Such investigations have mapped the presence of *Tetratheca juncea* within the site and this report aims to prepare a POM to assist in the management of the species to ensure the local population's long term survival. The development has been approved and the land is being transferred to the DECC.

1.2 Site Particulars

Locality – The site occurs on the Wallarah Peninsula.

LGA – Lake Macquarie City Council and Wyong Shire Council

Title(s) – Lot 2 DP 809795, Lot 2031 DP 841175, Lot 6 DP 774923, Lot 5 DP 774923.

Area – The site includes 60ha of land to be developed at CHB and 310ha of land that would be dedicated as offset lands to the NSW Government.

Boundaries – The site is bordered in the east by the ocean, to the south by Munmorah SCA and the remainder of the boundary is with Coal and Allied Lands.

Current Land Use – The lands at CHB include portions that have been highly disturbed by mining and large tracts of natural bushland that are not in current use.

Topography – The majority of the site is characterised by undulating low coastal hills, gently sloping to the shores of Lake Macquarie. The site rises to the headland at CHB where a steep drop to the ocean occurs.

The locality of the site within a regional context is presented in Figure 1-1, whilst the arrangement of the CHB development lands, Gwandalan development lands and offset lands is presented in Figure 1-2.

WARNING
No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from Harper Somers O'Sullivan Pty Ltd.

LAKE MACQUARIE
Gwandalan Development Lands
NORDS WHARF
PACIFIC HIGHWAY
WALLARAH NATIONA PARK
Crangan Bay
GWANDALAN
Middle Camp
Catherine Hill Bay
LAKE MACQUARIE STATE RECREATION AREA
MUNMORAH STATE RECREATION AREA
0 0.5 1km

TITLE: Figure 1-1 Site Locality

SCALE: 1: 21000 at A3 Size **DRAWN:** S. Bishop **APPROVED:** D. Landenberger

DATUM: MGA Zone 56 (GDA 94) **DATE:** 17/8/2007

LAYOUT REF: J:\JOBS\24k\24530 Hunter Valley\Draft .... ology\Southern Lands\ALL WORKSPACES\24530 Southern Lands Location FIGURE 1-3 A-A3.wor

CONTOUR INTERVAL: N/A

JOB REF: 24619

CLIENT: Rosecorp Pty Ltd

PLANNING SURVEYING ECOLOGY

HARPER SOMERS O'SULLIVAN

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

TITLE:
Figure 1-2
Site Layout

CLIENT:
ROSECORP PTY LTD

PLANNING SURVEYING ECOLOGY

SCALE: 1: 29000 at A4 Size

DRAWN: E. Graham APPROVED: D. Landenberger

DATUM: MGA Zone 56 (GDA 94) DATE: 22/11/2007

LAYOUT REF: J:\JOBS\24k\24619 - Gwandalan\Draftin .... nfo\24619.FIG2.SiteLayout.221107.wor

CONTOUR INTERVAL: N/A

JOB REF: 24619

HARPER SOMERS O'SULLIVAN
241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303
T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

1.3 Scope of the Study

The scope of this POM is to;

- Protect the *Tetratheca juncea* population within the site from threatening processes such as weed incursions, littering, inappropriate fire regimes and disturbances from human interaction; and

- Maintain the existing habitat including fire regime, soil conditions, hydrological regime, flora species composition and vegetation cover within the site.

Figure 1-3 shows the location of the *Tetratheca juncea* on the subject site.

WARNING

No part of this plan should be used for critical design dimensions. Confirmation of critical positions should be obtained from Harper Somers O'Sullivan Pty Ltd.

Note that this Vegetation Community Map depicts clearly defined boundaries between vegetation communities that are the product of individual interpretation and are not distinguished by clearly defined boundaries 'on the ground'. Therefore, this map should only be treated as an indication of approximate peripheries between delineated vegetation communities. Caution should therefore be exercised when using this data for purposes requiring high levels of accuracy. Furthermore, no account for intergrading areas between delineated vegetation communities has been made.

0 200 400
metres

LEGEND

- CHB Development Lands
- Catherine Hill Bay Boundary
- Tetratheca juncea clumps

TITLE: Figure 1-3 Location of Tetratheca juncea

CLIENT: Rosegroup Pty Ltd

SCALE: 1: 13000 at A3 Size **DRAWN:** Maya Beretta **APPROVED:** M. Doherty

DATUM: MGA Zone 56 (GDA 94) **DATE:** 16/12/2008

LAYOUT REF: j\jobs\24k\24619\Drafting\Mapinfo\Workspaces\24619-fig1-3tjrecordsCHB-161208

CONTOUR INTERVAL: N/A

JOB REF: 24619

HARPER SOMERS O'SULLIVAN

PLANNING SURVEYING ECOLOGY

241 DENISON STREET BROADMEADOW PO BOX 428 HAMILTON NSW 2303

T: 02 4961 6500 F: 02 4961 6794 E: survey@hso.com.au W:www.hso.com.au ABN 11 093 343 858

1.4 Qualifications and licensing

1.4.1 Qualifications

The POM was undertaken by the following ecologists from RPS HSO (Refer to Appendix B for Personnel Qualifications):

- Maya Beretta (B Env Sc),
- Matt Doherty (BLMC),
- Deborah Landenberger (B Sc (Hons)) and
- Craig Anderson (B App Sc (EAM))

1.4.2 Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Service Scientific Investigation Licence S10300 (Valid 30 November 2009);

1.4.3 Certification

As the principal author, I, Maya Beretta make the following certification:

- The results presented in the report are, in the opinion of the principal author and certifier, a true and accurate account of the species recorded, or considered likely to occur within the site;

- All research workers have complied with relevant laws and codes relating to the conduct of flora and fauna research, including the *Animal Research Act 1995, National Parks and Wildlife Act 1974* and the *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes*.

Signature of Principal Author and Certifier:

Maya Beretta
Ecologist
RPS Harper Somers O'Sullivan
December 2008

2 Ecology of *Tetratheca juncea*

2.1 Distribution and Abundance

This species has a restricted geographic range, and grows in disjunction populations from Wyong in the south to Bulahdelah in the North (Harden, 1993). Old records from the DEC database atlas from the late 1800s indicate that *T. juncea* populations existed within southern Sydney but those populations are now believed to be extinct. More recent survey by Payne (2000) found over 250 sites which *T. juncea* was located. The main populations are concentrated around the Lake Macquarie District with three disjunct populations at Beresfield, Karuah and Bulahdelah. Most of these populations contained less than 50 clumps (Payne, 2000).

Other populations of 25,000 have been located within the Wallarah Peninsula by Conacher Travers (2007). Of these, over 9,900 have been conserved within Wallarah National Park, with more individuals to be retained within the bush parks within the Coal and Allied development estates (RPS HSO, 2007).

The work of Payne (2000) states that all sub-populations of 100 plants or more are of very high conservation significance within the South-East quadrant in which this site occurs. However, at the time the whole population of *Tetratheca juncea* was estimated to be only 10,000 (Payne, 2000). This figure is an underestimation of the entire population throughout its range, but due to the cryptic nature of this species and the lack of extensive surveys a conservative approach was taken. Further surveys since that time has increased the known numbers of this species and this is supported by the large numbers located on the Wallarah Peninsula alone.

Some of the elements of the life-cycle of *Tetratheca juncea* have recently been discovered although much of the ecology is still unknown. However, as this species is an outcrosser (ie cannot self pollinate) and utilises buzz pollination (Gross *et al.,* 2003; Driscoll 2003) this type of reproduction leads to low fruit set. Buzz pollinators are highly specialized and require specific habitat requirements and this has been hypothised as one of the reasons for the species decline and fragmentation (Gross *et al.,* 2003). As the population at Catherine Hill Bay contains other species which utilise buzz pollination (eg *Hibbertia sp. and Dianella sp.*) it is considered that the habitat within the both the development lands and conservation lands provides good quality habitat for the buzz pollinator of *Tetratheca juncea*. Thus, it is vital that conservation of good quality habitat for the pollinator is conserved to ensure sufficient seed is set to ensure the survival of this species. The populations located within the offset lands are densely spaced and may be more successful in attracting a pollinator than the population within the development estate.

In conclusion, it is estimated that the population within the Wallarah Peninsula is at least 49,000 to date (RPSHSO (2007c, 2007d) and Conacher Travers (2007) data combined). **Error! Reference source not found.**1 is a breakdown of the numbers of *Tetratheca juncea* currently within adjacent conservation lands that has been surveyed to date. In addition to these populations, Wildthing (2003) located further populations of *Tetratheca juncea* within Catherine Hill Bay area and the lands to the south of Nords Wharf. Such a large number of known plants protected in several disjunct but proximate conservation areas bodes well for the long term security of the species in this locality.

Table 1 Known Distribution of *Tetratheca juncea* within the Wallarah Peninsula within Conservation Reserves

Site at Wallarah Peninsula	Numbers of *Tetratheca juncea*
Wallarah National Park and Habitat Corridor at Murrays Beach*	9900
Munmorah State Conservation Area**	296
Lake Macquarie State Conservation Area**	29
Coal and Allied Catherine Hill Bay Proposed Conservation Lands***	7,057
Coal and Allied Gwandalan Proposed Conservation Lands***	6,591
Coal and Allied Nords Wharf Proposed Conservation Lands***	5,933
Total in Conservation Reserves at Wallarah Peninsula	**29,510**

* Data from Conacher Travers (2007)

** Data from Payne (2000)

*** Data from RPS HSO (2008

2.1 Plant Morphology

Tetratheca juncea is a small prostrate sub-shrub, which grows from rhizomatous stock, which produces numerous stems with each stem being multi-branched. These stems can grow to over a metre in height and form clumps, which grow close together (Payne 2000). The stems are mostly leafless and have two to three wings, which are glabrous with minute tubercles (Harden, 1992).

The flowers are pink to purple, arising from the leaf axils either singly or in pairs (Harden, 1992). Most flowers have four petals and four ovules and are bisexual, odourless and nectarless (Gross *et al.* 2003). The presence of poricidal anthers suggests that the flower is buzz-pollinated (Gross *et al.* 2003). The main flowering period is from September to January, though this species has been observed to flowering at other times of the year (Driscoll, 2003).

2.2 Reproductive Strategies

2.2.1 Pollination

Pollination studies by Bartier *et al.,* (2001) determined through hand pollination that the breeding system is largely outcrossing. A study undertaken by Driscoll (2003) observed two native bees buzz-pollinating this species. These native bees have specific habitat requirements with one species (*Lasioglossum convexum*) living in tunnels in the ground and the other (*Exoneura sp.*) living in hollow logs.

2.2.2 Seed Set and Germination

Previous studies (Bartier *et al,* 2001, Payne 1998) have recorded very low seed set in *Tetratheca juncea* populations. This may be due to any number of reasons but some suggestions are low pollinator numbers, pollinators not efficiently pollinating the flowers and low species diversity of pollinators. Seed viability for *Tetratheca juncea* was considered to be reasonable and not a hindrance to recruitment (Bartier *et al.,* 2001).

Fire regimes are important for seed germination (Bartier *et al.,* 2001) but this area needs further investigation, as the exact fire regimes, which are suitable for *Tetratheca juncea*, are largely unknown. Seed germination is stimulated by smoke however seeds will also germinate when scarified (Bartier *et al.,* 2001). The seeds of *Tetratheca juncea* contain an elaiosome similar to *Acacia sp.,* which ants use as a food source in return for dispersing the seed. Therefore, it is assumed that ants may disperse *Tetratheca juncea* seeds. Soil seed bank studies indicate that the seeds are short lived and the seed bank is transient with seeds remaining viable for less than 12 months (Bartier *et al.,* 2001).

2.2.3 Vegetative Reproduction

Tetratheca juncea has rhizomes, which are used in vegetative reproduction, and this may explain why this species grows in clumps close together. Vegetative reproduction or clonal growth is where plants send out rhizomes (or runners) where they grow another genetically identical plant. Plants can employ vegetative reproduction when seed set is low. Transplantation of *Tetratheca juncea* may be difficult when the plant is clonal as each plant is connected by rhizomes and may be accessing vital resources from each connected clonal plant.

2.3 Habitat Requirements

2.3.1 Vegetation Community Associations

The dominant vegetation communities that this species occurs in are *Angophora costata* and *Corymbia gummifera* Open Forests to Woodlands (Payne 2001). Other vegetation communities in which *Tetratheca juncea* occurs are Coastal Heath, *Eucalyptus haemastoma* and occasionally *Corymbia maculata* / *Eucalyptus paniculata* (pers. Obs.). Payne (2001) indicates that this species prefers southwest and southeast facing aspects but this species has been observed (pers. Obs.) in other aspects.

2.3.2 Fire Regimes

Observations made by Norton (1994) suggest that slow burning fires which heat the soil, cook the root stock and kill the underground rhizomes whereas quick hot fires will burn the above ground stems but the rhizomes survive allowing resprouting of stems after fire. The ideal fire regimes are unknown but it is apparent that *Tetratheca juncea* does respond to fire.

2.3.3 Mycorrhizal Assocations

Mycorrhizal associations are symbiotic relationships between fungi and roots, which assist in the uptake of nutrients. Bartier *et al.,* (2001) found two species (*Glomus* and *Acaulospora*) of fungi present within the roots of *T. juncea*. These are commonly occurring mycorrhiza and it was concluded that this species does not have specific mycorrhiza associations.

2.3.4 Geology and Soils

The underlying geology across the range of *Tetratheca juncea* varies with the main soil types being erosional soils on such landscapes as Doyalson and Awaba in the south and Killingworth, River Road and Gan Gan in the north and Ten Mile Road to the west. These soil types are underlain by a range of geologies including the Munmorah Conglomerates (Murphy, 1993), Newcastle coal measures (Matthei, 1995) and Nerong Volcanics (Murphy, 1995).

3 Catherine Hill Bay *Tetratheca juncea* Population

3.1 Distribution and Abundance

Harper Somers O'Sullivan undertook two surveys in 2007 and 2008. These surveys recorded *T. juncea* from both the Catherine Hill Bay development lands and the offset lands. The surveys of the development lands were undertaken from the 12th-16th of November 2007 and identified 189 *T. juncea* clumps. Targeted surveys of the offset lands were undertaken on the 21st, 23rd and 25th of July 2008 and identified 1024 clumps of *T. juncea.*

Additionally, much larger populations are currently conserved within Wallarah National Park to the north of the site (over 9,900 individuals) and further populations located by RPS HSO (2007) within Coal & Allied lands at Gwandalan and Nords Wharf area which would be conserved in conservation reserves the number conserved is likely to increase. Thus, in the Wallarah Peninsula the total number of *T. juncea* clumps totals over 49,000. Of these over 30,000 clumps are to be conserved in conservation reserves. Such a large number of known plants protected in several disjunct but proximate conservation areas bode well for the long term security of the species within the locality. Therefore, as the large numbers of *T. juncea* and the majority of the habitat will be conserved it is considered unlikely that any impact will be significant in regards to the long term viability of the Wallarah population. Figure 1-3 shows the distribution of *Tetratheca juncea* within the Catherine Hill Bay site.

3.2 Habitat Description

3.2.1 Vegetation Characteristics

Within the development lands, *T. juncea* was identified within the Coastal Plains Smooth-barked Apple Woodland. The dominant tree species included *Angophora costata* (Smooth-barked Apple), *Corymbia gummifera* (Red Bloodwood), *Eucalyptus piperita* (Sydney Peppermint), *Eucalyptus capitellata* (Brown Stringybark), and occasionally *Eucalyptus resinifera* subsp. *resinifera* (Red Mahogany). The mid storey consisted of *Allocasuarina littoralis* (Black She-oak), *Exocarpus cupressiformis* (Ballart Cherry), juvenile *Eucalyptus capitellata* (Brown Stringybark) and *Corymbia gummifera* (Red Bloodwood).

Within the offset lands, *T. juncea* was identified predominantly in the Narrabeen Wallarah Sheltered Grassy Forest and the Coastal Plains Scribbly Gum Woodland. It has also been recorded in Apple/Palm Gully Forest, Coastal Plains Smooth-barked Apple Woodland and Coastal Clay Heath.

4 Management Strategies

4.1 Protection of Tetratheca juncea

Tetratheca juncea is listed on Schedule 2 of the *Threatened Species Conservation Act* 1995 as Vulnerable and is protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 as Schedule 1 Part 2 Vulnerable. Populations of *Tetratheca juncea* in the past have been impacted upon by anthropogenic factors such as urban development, grazing, weed incursions and inappropriate fire regimes.

Populations of *T. juncea* in the region will be protected within the conservation estates that have been transferred to DECC ownership. DECC will ensure the protection of populations of this species by managing the site in accordance with DECC guidelines and policies. It is recommended that DECC ensures that paths are not located in areas close to *T. juncea* populations to minimise any adverse impacts and undertake weed control programs within the conservation lands.

The NSW NPWS, who will manage the conservation lands in perpetuity for conservation manage many other reserves in the area that contain *T. juncea* including Wallarah National Park, Munmorah SCA and Lake Macquarie SCA. This agency has extensive experience in the management of *T. juncea* in the locality and will manage the populations within the conservation lands in accordance with their guidelines and policies.

4.2 Education of Residents

Disturbances from human interaction on *Tetratheca juncea* populations within the site can be reduced through the education of residents. This education can be in the form of a pamphlet, which can be given to residents when purchasing a block of land. Information that can be included within the pamphlet could be information on the ecology of *Tetratheca juncea* and environmental factors which impact upon its life cycle. Residences who purchase blocks containing *Tetratheca juncea* should be informed that they have this plant within the block and given guidelines on how to manage the plants.

In order to manage the species the following rules are suggested to help maintain the populations within the site:-

- No rubbish dumping within areas containing *T. juncea*.
- No picking of *T. juncea* flowers or stems.
- No domestic pets allowed within the areas containing *T. juncea*.
- No removal of logs for firewood.
- No walking through areas of *T. juncea* populations.

4.3 Bushfire Management and Tetratheca juncea

Bushfire management is a very complex and contentious issue that often involves balancing of safety requirements against vegetation and habitat management requirements.

Before hazard reduction burns occur within the community land, a review of the Bushland Management Plans and the activities of the Rural Fire Service with regard to the effect on appropriate fire frequencies for vegetation and the timing must occur.

4.3.1 Managing Asset Protection Zones and *Tetratheca juncea*

The Bushfire Threat Assessment Report for the site by Barry Eadie Consulting (2007) recommended an asset protection zone (APZ) of between 15 to 25m was required dependant on the location within the development area.

It is recommended that the *Tetratheca juncea* plants located within the APZ areas be fenced off and no removal of the understorey, other than for weed management, be undertaken within these areas. This will then allow modification of the remaining native vegetation to be undertaken in accordance with the recommendations within the Bushfire Threat Assessment (Barry Eadie Consulting, 2007). This will allow the protection of *T. juncea* plants and the protection of residences to the threat of bushfire.

4.3.2 Managing Fire Regimes

Frequent fire events are thought to promote a dense understorey of Blady Grass and Bracken Fern which inhibits the regrowth of *Tetratheca juncea* after fire (NPWS 2000). Slow cool fires are also known to destroy the rootstock (Norton, 1994). Therefore the fire frequency of hazard reduction burns is recommended to be of medium frequency (approx once every five years). The burns should preferably take place during the winter months to coincide with *T. juncea* seed being within the soil seed bank and should be avoided during the spring months when seed reserves are low (Bartier *et al.,* 2001).

After each fire event weed management should be undertaken if deemed necessary after a post fire site inspection, in the immediate months after fire to ensure that Blady Grass, Bracken Fern and exotic weeds do not outcompete with *T. juncea* when regrowth is occurring. A recommended weeding regime could commence at 1 month after the fire with ongoing weeding at 3 month, 6 month and 12 month intervals after the fire. As the conservation lands have been transferred to the DECC, the management of weeds and threatened flora will be undertaken by the NSW NPWS in accordance with their policies.

4.4 Weed Management

The overall aim for the weed management is to restore and maintain an ecosystem where natural regeneration can occur, to re-establish a native plant community where native vegetation thrives, and to maintain an area where weed species do not flourish.

To achieve this, a neighbourhood community group should be formed and would meet and work on weed management of the vegetation surrounding the *Tetratheca juncea* populations. This group could include other local community groups with an interest in rehabilitating bushland in the locality. Working bees could be once a week

/ fortnight / month, depending on the preference of the community groups. Advice and physical assistance can be gained from the *Lake Macquarie Landcare Resource Office* located at Fassifern (Ph: (02) 4959 5080).

Weeds that should be focused on for this site are Lantana, Privet, Bitou Bush, Blackberry, Wandering Jew, Camphor Laurel, Crofton Weed, Fishbone Fern, Paddy's Lucerne and Purple-Top. Of these weeds Lantana, Privet and Bitou Bush should be prioritised.

4.4.1 Weeding Near *Tetratheca juncea* Clumps

This species has a rhizomatous rootstock and these rhizomes can run along the top of the soil under the leaf litter as well as within the soil matrix (Pers. Obs.). Therefore, care should be taken when removing weeds close to *Tetratheca juncea* clumps (<30 cm) to avoid disturbance of the roots system.

4.4.2 Methods for Weed Removal

Working Bees should incorporate individual and group aims in the weed management of the *Tetratheca juncea* populations within site.

The following are suggested weed removal and monitoring techniques which can be employed within the site.

1. **Weed removal**.

    a. Weeding direction on the site - working from areas with native plants towards weed-infested areas.

    b. Let native plant regeneration dictate the rate of weed removal. The site may need several visits over a period of months or even a year or more to remove weeds that are competing with regenerating native plants. Weed regeneration on weeded sites can be an issue for a period of years until the native plants are established; established native plants shade the soil and reduce ability for weeds to regenerate.

    c. Particular care should be taken when removing weeds from the creek lines, as large amounts of exposed soil caused by weed removal could result in serious damage to creek banks during rain events. Complete removal of large areas of weeds such as Lantana and Privet would result in a loss of habitat for many small birds. Removal should be a gradual process allowing time for native vegetation to regenerate to sufficient density to be used as habitat.

    d. Weeds removal is specific for individual weeds.

Lantana

- Small to medium sized Lantana plants can be pulled out by hand (care should be taken to remove <u>all</u> of the roots).

- Large Lantana plants are removed by hacking into the centre of the plant and taking out the crown (the base of the plant and start of the root system) - cut as close to the roots as possible and paint the cut stem with Roundup. Also cut and paint with

Roundup or remove all roots of the sections of stem which have layered (stems where roots have developed).

- Lantana that has climbed up into trees and is entwined with the tree branches, cut and separate the long canes from the main plant and leave them to rot. It may look untidy but pulling them out can damage the tree.

Privet

- Privet removal varies from drilling trees to injecting herbicide, cutting and painting with herbicide, spraying or hand pulling out (care must be taken to remove all the root system).

Bitou Bush

- Bitou Bush removal varies, it can be pulled out by hand (care should be taken to remove all of the roots) and also the roots on the stem which have layered. Follow up weeding is essential, as Bitou Bush seeds can remain viable in the soil for several years.

- Roundup can be used by cutting as close to the roots as possible and painting the cut stem with Roundup. Also cut and paint with Roundup or remove all roots on the sections of stem which have layered (stems where roots have developed).

2. Consistent **monitoring of sites** that have been worked on, to increase the native plant regeneration and decrease the weed regeneration on these sites.

4.5 Stormwater and Nutrient Runoff

4.5.1 Stormwater Runoff

The report by Northrop (2002) recommends the retention of stormwater runoff onsite. This option would be suitable for the protection of *Tetratheca juncea* as increased stormwater runoff may be detrimental to the health of these populations. The location of any tanks and detention basins should avoid areas of *Tetratheca juncea.* Detention basins should be designed and constructed in such a manner as to mimic natural water flows of the site so that it does not reduce or increase the amount of stormwater entering the flowlines of the conservation lands.

4.5.2 Nutrients

The fertilisation of lawns should be prohibited within a 20m buffer of *T. juncea* plants. Native plants are particularly susceptible to excessive nitrogen and phosphorous uptake, which can kill or be detrimental to their health. Recommended garden fertiliser would be a native garden fertiliser, which is low in phosphorus and nitrogen.

4.6 Monitoring and Maintenance

Monitoring and maintenance of the *Tetratheca juncea* populations within the Community Land areas will be the responsibility of the NSW NPWS who will manage the conservation lands in perpetuity and are part of the regulatory framework protecting threatened species in NSW.

5 Conclusions

It has been concluded that should all the measures addressed within this Plan of Management for *Tetratheca juncea* be instigated then the integrity and ecological value of the *Tetratheca juncea* populations can be maintained within the community land in the long term. Populations protected within the conservation lands will be managed by the NSW NPWS who are part of the DECC and are the State's leading government agency on threatened species and their management.

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APPENDIX A Memorandum of Understanding

THE MINISTER FOR THE ENVIRONMENT

and

THE MINISTER FOR PLANNING

and

COASTAL HAMLETS PTY LTD

and

LAKESIDE LIVING PTY LTD

MEMORANDUM OF UNDERSTANDING

I V KNIGHT
Crown Solicitor
60-70 Elizabeth Street
SYDNEY NSW 2000

200600938 D2006/178441

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MEMORANDUM OF UNDERSTANDING

THIS MOU is made on 16TH of October 2006.

Between

1. **THE MINISTER FOR THE ENVIRONMENT** of Level 36, Governor Macquarie Tower, 1 Farrer Place, Sydney in the State of New South Wales; and

2. **THE MINISTER FOR PLANNING** of Level 34, Governor Macquarie Tower, 1 Farrer Place, Sydney in the State of New South Wales

   (together, the "Government"); and

3. **Coastal Hamlets PTY LTD** ACN 100 126 994 (the "CHB Landholder").of 51 Riley St, Woolloomooloo, NSW 2011, a Rosecorp group company; and

4. **Lakeside Living Pty Ltd** ACN 054 400 814 (the "Gwandalan Landholder") of 51 Riley St, Woolloomooloo, NSW 2011, a Rosecorp group company.

Background

A. The New South Wales Government intends to implement an Environmental Land Offset Scheme for the Lower Hunter region to complement and support the Lower Hunter Regional Strategy and the Lower Hunter Regional Conservation Plan.

B. The Environmental Land Offset Scheme aims to:

   (i) increase public ownership of certain land in the Lower Hunter region for dedication as a conservation reserve; and

   (ii) recognise the development potential of certain other land in the Lower Hunter region.

C. The purpose of this MOU is to set out the parties' intentions with respect to the implementation of the Environmental Land Offset Scheme, insofar as it concerns the Landholder.

1. Definitions and interpretation

1.1 In this MOU, unless the context otherwise requires:

"**Conservation reserve**" means any land intended to be reserved or dedicated under the *NPW Act* and includes references to a national park, nature reserve, state conservation area or regional park, as those terms are defined under that Act

"**Development potential of Schedule 1 land**" means the development potential specified in Schedule 1 for each parcel of Schedule 1 land (either hectares or dwellings or both).

"**Dwelling**" has the same meaning as in the *Standard Instrument—Principal Local Environmental Plan.*

"**Environmental Land Offset Scheme**" insofar as it concerns the Landholder means the Environmental Land Offset Scheme described in clause 3 of this MOU.

"**EP&A Act**" means the *Environmental Planning and Assessment Act 1979*, as amended from time to time.

"**Lower Hunter Regional Conservation Plan**" means the Lower Hunter Regional Conservation plan released by the NSW Department of Environment and Conservation, published on that Department's website and as amended from time to time.

"**Lower Hunter Regional Strategy**" means the Lower Hunter Regional Strategy released by the NSW Department of Planning, published on that Department's website and as amended from time to time.

"**Map**" means the untitled map identifying the Coastal Hamlets Pty Ltd holdings in Catherine Hill Bay that is incorporated into this MOU by reference.

"**MOU**" means this Memorandum of Understanding which includes the Schedules and map that are incorporated into this MOU by reference

"**NPW Act**" means the *National Parks and Wildlife Act 1974* as amended from time to time.

"**Rezoning**" means the mechanism of changing the landuse zone for a parcel of land contained in a environmental planning instrument (as defined by the the EP&A Act), noting that this change in landuse zone may be effected by the gazettal of a State Environmental Planning Policy or a local environmental plan.

"**Schedule 1 land**" means the parcels of land owned by the CHB Landholder and the Gwandalan Landholder, referred to in the Lower Hunter Regional Strategy and identified in Schedule 1, or part thereof.

"**Schedule 2 land**" means the parcels of land owned by the CHB Landholder and identified in Schedule 2, or part thereof.

"**TSC Act**" means the *Threatened Species Conservation Act 1995* as amended from time to time.

"Transferred Schedule 2 land" means Schedule 2 land, or part thereof, transferred to the Minister for the Environment in accordance with clause 3.2.

"Wyong Residential Development Strategy" means the Wyong Residential Development Strategy released by Wyong Shire Council in December 2002 and published on the Council's website.

2. Implementation

2.1 The parties are committed to using their best endeavours to implement this MOU.

2.2 The parties acknowledge and agree that:

(a) this MOU is intended to express the parties' objectives and firm intentions with regard to those matters with which it deals, but is not intended to create enforceable or binding legal obligations between them;

(b) nothing in this MOU shall be taken to fetter the discretion of the Minister for Planning in exercising functions under the *EP&A Act* or the Minister for the Environment in exercising functions under the NPW Act or the TSC Act; and

(c) nothing in this MOU is intended to constitute a representation, warranty or guarantee by or on behalf of the Government, the Minister for Planning or the Minister for the Environment.

2.3 All parties acknowledge and agree that they have not relied or acted or forborne from acting in any way as a result of any statement made by any of the parties in this MOU or in discussions leading up to this MOU.

3. The Environmental Land Offset Scheme

3.1 The Landholder intends to develop land identified in the Lower Hunter Regional Strategy by preparing a Rezoning application as soon as practicable and at least within 5 years that is consistent with the development potential of Schedule 1 land.

3.2 The Minister for Planning intends to use reasonable endeavours to allow the Landholder to achieve the development potential of Schedule 1 land by either:

(a) Rezoning the land through an amendment to State Environmental Planning Policy 2005 (Major Projects) and approval of any concept plan submitted under Part 3A of the EP&A Act; and/or

(b) Facilitating the rezoning of the land through the gazettal of a Local Environmental Plan prepared by the relevant local government authority and made by the Minister for Planning and approval of any concept plan submitted under Part 3A of the EP&A Act ; and/or

(c) Any other means that achieves or encourages the more intensive use of the land;

in accordance with the Lower Hunter Regional Strategy, the Lower Hunter Regional Conservation Plan and subject to the requirements of the *EP&A Act*.

3.3 The Landholder intends to transfer ownership of Schedule 2 land to the Minister for the Environment upon the rezoning of Schedule 1 land.

3.4 The Minister for the Environment intends to ensure Transferred Schedule 2 land is dedicated as part of the national park estate or as a conservation reserve.

3.5 The Landholder intends not to undertake any action or activity, pending transfer of Schedule 2 land or rezoning of Schedule 1 land that will have detrimental effect on the conservation or Aboriginal heritage values of Schedule 2 lands except where the Landholder is

(a) directed to undertake such an action or activity by another Government agency or instrumentality (such as the Rural Fire Service and the NSW Department of Primary Industries), or

(b) is otherwise required by law to undertake such an action or activity.

4. Agreement

4.1 Notwithstanding clause 3, the details of the Environmental Land Offset Scheme described in clause 3 are the subject of ongoing negotiation by the parties, which they propose will form part of a legally enforceable agreement to be entered into by them.

4.2 All parties are to use their best endeavours to enter into such an agreement referred to in clause 4.1 as soon as possible noting a target date of three months for this to occur.

4.3 The parties acknowledge that the proposed agreement referred to in clause 4.1 will include a schedule of commitments that set out the sequencing and staging of Schedule 1 land and the dedication for conservation of Schedule 2 lands.

4.4 The parties acknowledge that:

(a) If there is any reduction in Schedule 2 Land to be transferred then a proportional reduction will result for the development potential of the Catherine Hill Bay Schedule 1 Land

(b) If the development potential of the Catherine Hill Bay Schedule 1 Land in relation to the number of dwellings or lots to be achieved is reduced then a proportional reduction will occur in the amount of Schedule 2 Land to be transferred to the Minister for the Environment

5. Term

5.1 This MOU starts on the date it is signed by both parties and continues until the parties enter into an agreement of the type referred to in clause 4, or 5 years, whichever is the later.

This Memorandum of Understanding is signed on 16TH October 2006.

The Honourable Bob Debus MP
The Minister for the Environment

The Honourable Frank Sartor MP
The Minister for Planning

Bryan Rose, Director, for and on behalf of
Coastal Hamlets Pty Ltd

Bryan Rose, Director, for and on behalf of
Lakeside Living Pty Ltd

SCHEDULE 1 – POTENTIAL DEVELOPMENT LANDS

This Schedule forms part of the MOU.

Schedule 1 Land

Property description	Map reference	Development potential
	Catherine Hill Bay – lands shaded green	• Residential development covering up to 60 hectares to achieve 600 dwellings
	Gwandalan – identified as Precinct 1A in the Wyong Residential Development Strategy	Residential development over 26 hectares to achieve 12 dwellings per hectare as proposed in the Residential Development Strategy

SCHEDULE 2 – ENVIRONMENTAL LANDS OFFSETS

This Schedule forms part of the MOU.

Schedule 2 Land

Property description	Map reference	Area
	Catherine Hill Bay and Wallarah Peninsula – Coastal Hamlets Pty Ltd lands within the white outline and not shaded green	Approximately 310 hectares

APPENDIX B Personnel Qualifications

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name: Toby Lambert

Office: RPS Harper Somers O'Sullivan

Position in Company: Senior Ecologist

Qualifications / Memberships:
Bachelor of Environmental Science
Ecological Consultants Association of NSW
NSW Driver's Licence (Class C)
OH&S Induction Training (Green Card)
NPWS Scientific Investigation Licence
NSW Animal Ethics Research Authority

Areas of Expertise:

- Environmental and ecological impact assessment reporting
- Flora, fauna and habitat survey methodology design and management
- Detailed understanding of threatened species legislation and issues
- Terrestrial fauna surveys
- Renewable energy assessment
- Bushland and vegetation management
- Complex holistic project management
- Local, State and Commonwealth project co-ordination
- Dispute resolution and mediation

Experience Includes:

Toby has over twelve years experience in undertaking and managing a diverse array of ecological and environmental surveys and assessments. Toby has produced ecological and environmental documentation for private and public projects ranging in complexity. These include a number of wind farms throughout Australia and New Zealand, coal mines and a range of infrastructure projects within the Hunter region. Toby has also managed ecological masterplanning for residential projects in Sydney, the Central Coast and the Hunter. Toby is also currently the project manager for the environmental component of the development of the Hunter Economic Zone industrial estate at Kurri Kurri, the largest industrial estate in NSW.

Toby's fields of special competence are Environmental Impact Assessment and mediation, flora, fauna and habitat survey method, design and identification, detailed understanding of legislation and threatened species issues, terrestrial fauna surveys and project management.

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name:	Deborah Landenberger
Office:	RPS Harper Somers O'Sullivan
Position in Company:	Ecologist/ Botanist
Qualifications / Awards	B. Sc (Hons – First Class) NSW Driver's Licence (Class C) OH&S Induction Training (Green Card) NPWS Scientific Investigation Licence NSW Animal Ethics Research Authority
Memberships:	Australian Plant Society Australian Network for Plant Conservation Australasian Native Orchid Society

Areas of Expertise:

- Flora identification and habitat assessment
- Targeted threatened flora surveys
- Delineation and mapping of vegetation communities
- Endangered Ecological Community (EEC) assessment
- Threatened Flora Management Plans
- Experience in PATN Statistical package
- Ecological Monitoring and Reporting
- Vegetation and Bushland Management Plans
- Project Management and quote preparation
- Experience with GPS/GIS for project design and mapping
- Detailed understanding of environmental legislation

Project Experience Includes:

Deborah Landenberger has broad range of Ecological Assessment reporting experience underpinned by over 10 years of ecological field experience. Experience within the consulting industry has primarily included a wide range of flora assessment disciplines as required by a wide range of public and private clients. Debbie has a strong grounding in threatened flora species ecology and vegetation mapping ranging from the South Coast of NSW to Guyra in the north west and Port Macquarie on the north coast of NSW.

Debbie's strong botanical interests have been central in a number of important projects, these include major vegetation mapping projects in the south of Lake Macquarie, Minmi to the west of Newcastle, Ben Lomond (near Guyra), Oberon, North Arm Cove, Singleton and Bulahdelah. Her knowledge of non-parametric statistics, such as PATN statistical program has enabled RPS HSO to undertake large mapping projects using sound scientific methodology. Her knowledge of threatened flora species includes 2 years research on the threatened flora species *Tetratheca juncea.* Debbie's wide ranging knowledge and experience of Australian flora is a vital part of RPS HSO's ability to meet the consultation and regulatory needs of the development community.

RPS HARPER SOMERS O'SULLIVAN

Curriculum Vitae

Name:	Maya Beretta
Office:	RPS Harper Somers O'Sullivan
Position in Company:	Ecologist
Qualifications / Awards	B. Env Sc NSW Driver's Licence (Class C) NPWS Scientific Investigation Licence Senior First Aid
Memberships:	Australasian Bat Society Australian Network for Plant Conservation

Areas of Expertise:

- Flora identification and vegetation survey
- Biodiversity survey and assessment
- Habitat assessment
- Endangered Ecological Community (EEC) assessment
- Ecological Monitoring and Reporting
- Property Vegetation Plans (PVP under the Native Vegetation Act, 2005)
- Experience with GPS/GIS for project design and mapping
- Detailed understanding of environmental legislation

Project Experience Includes:

Maya Beretta has broad range of Ecological Assessment reporting experience underpinned by 7 years of ecological field experience. Experience within the public sector has primarily included environmental impact assessment of vegetation clearance proposals as required by a wide range of public and private clients and biodiversity assessment of private conservation areas. Maya has attained Biodiversity Accreditation under the Native Vegetation Act 2005 and is experienced in the use of the Property Vegetation Plan Developer and associated tools.

Maya has a strong grounding in vegetation ecology and flora identification in the catchments of the Central West, Lachlan, Southern Rivers and Hawkesbury Nepean ranging from the Victorian boarder to Walgett in the north west of NSW. Maya has also been involved in fauna survey throughout the Central West and Far Western areas of NSW and has experience in trapping and identification of mammals and reptiles.