
Vegetation assessment for the Thornton North Master Plan, Maitland LGA

Report to

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EXECUTIVE SUMMARY

Investigations have been made into the vegetation occurring in the Thornton North area of Maitland local government area, as part of the Thornton North Master Plan currently in development. The 900ha site supports less than 30% native vegetation, with the balance totally cleared or highly modified for agricultural pursuits.

Following **survey and mapping** of the study area, the following LHCCREMS vegetation communities have been identified on a revised map of the site:

- Seaham/ Lower Hunter Spotted Gum – Ironbark Forest Intergrade (MU's 16 & 17, coded here as MU16/17)
- Hunter Lowlands Redgum Forest (MU 19)
- Disturbed Freshwater Wetland Complex (MU46, coded here as Xw)

The vast majority of remnant vegetation remaining on the site conforms to either of the Lower Hunter Spotted Gum – Ironbark Forest (MU17) or the Seaham Spotted Gum – Ironbark Forest (MU16). Modelling undertaken by NPWS (2000) and Eco Logical (2002) for the LHCCREMS project show the site as supporting MU17, however field investigations suggest that elements of both communities are present, and that perhaps the area has closer affinities with MU16. The Thornton area occurs in a transition zone between the two communities, and it is not surprising that elements of floristic drift are apparent.

As part of the **conservation assessment**, the following outcomes were reached:

- the Lower Hunter Spotted Gum – Ironbark Forest (MU17) has undergone an estimated 58% loss in distributional range within the LHCC region since European settlement. The corresponding figure for the Seaham Spotted Gum – Ironbark Forest (MU16) is 55%, however it is unclear how far north this community extends outside of the LHCC region. Consequently, irrespective of which community is actually present, both potentially qualify as Vulnerable ecological communities under State and Federal threat status criteria.
- The Lower Hunter Spotted Gum – Ironbark Forest (MU17) is represented only in Werakata National Park near Cessnock (1600ha), while the Seaham Spotted Gum – Ironbark Forest (MU16) occurs in both Wallaroo and Karuah Nature Reserves (unknown extent, but estimated to be around 500ha).
- small portions of the study area support vegetation which can be considered part of the Hunter Lowlands Redgum Forest, an Endangered Ecological Community under the NSW *Threatened Species Conservation Act 1995*. Some of these areas are highly modified and would be difficult to rehabilitate to natural conditions. Only Werakata National Park currently protects this vegetation type.
- the condition of vegetation remaining in the study area is generally poor to moderate, due primarily to past and present agricultural activities which have partially or fully cleared large areas of land, and have disturbed or modified understorey vegetation. However, portions of land within the buffer zones of existing clay quarries appear to support good examples of vegetation which have not been markedly impacted upon by logging or grazing. Such examples are very rare in the Hunter region, and consequently these lands are considered significant.
- the area supporting native vegetation of reasonable-to-good condition lies at the northern extreme of a significant regional corridor, but is separated from the nearest sizeable vegetation to the north by a distance of at least 7km.

Consequently, the Thornton North study area does not contribute to regional north-south habitat linkages.

- no threatened or otherwise significant plant species are known from the study area, although some specimens of *Eucalyptus tereticornis* were thought to contain genes of the vulnerable *Eucalyptus glaucina*, based on study of the latter species elsewhere in the lower Hunter Valley.

It is **recommended** that those portions of the study area shown to support good quality native vegetation be retained to assist in the regional conservation of valley floor vegetation. Due to the linear nature of such portions, it is further recommended that additional areas currently supporting canopy trees over modified understoreys be retained as linkages (possibly involving rehabilitation). Maps showing these constraints to further development have been included.

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1.0 BACKGROUND

The City of Maitland is currently experiencing increasing population growth in the east of the LGA, where the supply of suitable land is limited. Planning NSW recognises the Maitland corridor as a key area for accommodating the anticipated growth in the regional population, and in response Council has established the Maitland Urban Settlement Strategy to plan for future development. Areas to the north of Thornton within this Strategy are currently under investigation, and support the following advantages:

- Proximity to key transport infrastructure and urban centres
- Attractive character of the area
- Potential to incorporate vegetation linkages with future development
- Existence of large, relatively constraint-free areas
- Proximity to water and sewerage infrastructure

This report assesses the vegetation and flora of the Thornton North study area, and forms part of wider investigations being co-ordinated by Parsons Brinckerhoff Australia Pty Limited. Attributes assessed include the value and importance of the remnant vegetation locally, regionally and Statewide; the extent of vegetation that should be retained with future urban development; the potential for trade-offs and offsets; and any potential compensations, such as revegetation activities.

2.0 THE STUDY AREA

The Thornton North investigation area occupies approximately 900 ha of land to the north of the existing township of Thornton, and adjoins existing residential areas (Figure 1). Its boundaries are partly defined by the 1 in 100 year flood level, which is linked to the nearby Four Mile Creek and the Thornton/ Beresfield wetlands.

3.0 PREVIOUS VEGETATION STUDIES

A number of vegetation studies and assessments of conservation significance within the local area and region are relevant to the current study:

Maitland LGA Vegetation Mapping (Hill in prog.)

Currently nearing completion, vegetation survey and mapping of the vegetation remaining within Maitland LGA is expected to provide detailed information on the type

and condition of remnant vegetation present within the City (Hill in prep.). As the LGA retains only around 10% of its former vegetative cover, this study is likely to find that the vegetation remaining is locally and regionally significant, and should be retained or managed to conserve biodiversity as much as possible.

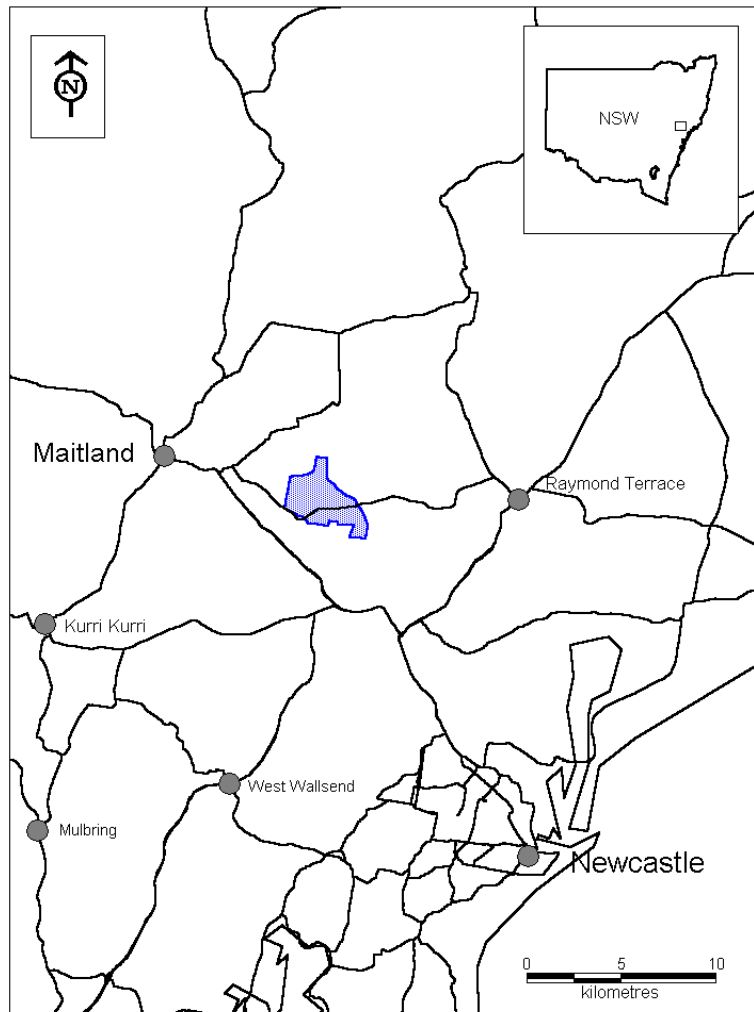


Figure 1 Location of the Thornton North study area.

Lower Hunter & Central Coast REMS Project (NPWS 2000; Eco Logical 2002)

Involving seven local Councils, the LHCCREMS project undertook a major regional survey, classification and mapping (modelling) program aimed at prioritising the management of remaining vegetation in the Lower Hunter Valley and Central Coast area, and to allow a co-ordinated approach to future development in the region. While the resultant modelling

is limited in use at a local level, this study provides important contextual information on the vegetation throughout the region. A recent revision of the mapping layer has included detailed API mapping of extant vegetation, improving accuracy on the NPWS (2000) version for vegetated vs non-vegetated areas (Eco Logical Pty Ltd 2002).

As presented in the revised 2002 modelling, the Thornton North study areas supports the following REMS vegetation communities:

- MU5 Alluvial Tall Moist Forest (*Eucalyptus saligna*/ *Syncarpia glomulifera*/ *Glochidion ferdinand*)
- MU17 Lower Hunter Spotted Gum Ironbark Forest (*Corymbia maculata*/ *Eucalyptus fibrosa*/ *Eucalyptus punctata*)
- MU46 Freshwater Wetland Complex (*Ludwigia peploides* subsp. *montevidensis*/ *Paspalum distichum*/ *Eleocharis sphacelata*/ *Juncus usitatus*)
- MU37 Swamp Mahogany – Paperbark Forest (*Melaleuca quinquenervia*, *Eucalyptus robusta*, *Casuarina glauca*)

Over 95% of the site is shown to support MU17.

Maitland Greening Plan (Maitland City Council 2002)

The Maitland Greening Plan is a collection of information about vegetation and related environmental issues in the Maitland area. It is intended to guide management of remaining native vegetation in the LGA, and to provide an appreciation of the importance of vegetation and environmental issues. Within the context of the current project, the Plan provides a useful backdrop against which future use of the Thornton North area can be gauged.

Hunter Valley Remnant Vegetation Project (Peake in prep.)

Co-ordinated by the Hunter Catchment Management Trust, the remnant vegetation project aimed to survey and map the remnant vegetation occurring within the mid-Hunter Valley from Scone to Branxton. Preliminary results of this project are provided in Peake (2000), and indicate that much of the remnant vegetation in the Hunter is dominated by even-aged trees, with little structural diversity. Most of the remaining vegetation on the valley floor is regrowth from previous clearing, and the presence of naturalised exotic species is common. In the context of Thornton North, this study provides important contextual information for lands to the west of the Thornton North study area.

Vegetation survey of Werakata National Park (Bell 2001)

Survey and mapping of Werakata National Park near Cessnock has been completed. This reserve is the only formal conservation area in the region containing Lower Hunter Spotted Gum – Ironbark Forest (MU17, 1600ha), and hence it is of considerable importance locally and regionally. Several other aspects of the vegetation at Werakata are also applicable to the Thornton North study area, such as the distribution of Hunter Lowlands Redgum Forest (MU19 of NPWS 2000).

Preliminary vegetation survey of Karuah and Wallaroo Nature Reserves (Bell 2002)

A preliminary plot-based survey of the vegetation within Wallaroo and Karuah Nature Reserves was undertaken in 2002. These two reserves lie approximately 20km and 30km respectively to the north-east of Thornton North, and support similar vegetation. No mapping was undertaken, but is planned for a latter date when funding becomes available.

Key habitats and corridors mapping (NPWS 2002)

Preliminary mapping of key habitats and corridors in the Hunter and areas to the north have been undertaken by staff from the Northern Directorate of NPWS. This mapping identifies potential corridors and wildlife movement pathways, as well areas supporting keystone resources for forest fauna species. The Thornton North area does not configure within any of the major corridors mapped by NPWS.

Register of regionally significant plant species within the Hunter catchment (Bell *et al.* 2003)

In response to a recognised need for scientifically-based information on significant plant species in the region, a working register has been developed under the auspices of the Hunter Region Botanic Gardens. The register is intended to be publicly available (Version 1 is currently included on the Hunter Region Botanic Gardens web site), and will be periodically updated as new information comes to hand. Information contained in the register will assist in assessing the conservation significance of the vegetation at Thornton North.

4.0 METHODOLOGY

4.1 Mapping of Vegetation Communities

An ortho-rectified digital mosaic of aerial photographs covering the study area was used as a base for preparation of the vegetation map. Aerial photographic interpretation using a stereoscope and standard techniques was not undertaken due to the non-availability of hard copy aerial photographs. Linework representing areas of differing vegetation extent were digitised directly on-screen, and coded with the appropriate vegetation community tag based on field knowledge. In addition, vegetation condition was assessed using the following disturbance codes:

- Xr 1 consistent cover of widely spaced canopy trees (>20m between adjacent trees)
- Xr 2 consistent cover of moderately spaced canopy trees (10-20m between adjacent trees), and with observable understorey disturbance, such as that conversant with grazing practices.
- Xw modified wetland depressions
- Xs regenerating open forest subsequent to clearing

4.2 Vegetation Survey

As part of the City-wide vegetation mapping project, two detailed floristic plots have been completed within the current study area (Hill in prep.). This data has been made available for incorporation into the Thornton North dataset, and were to be combined with new floristic data collected in the area. Standard vegetation survey techniques are employed to record all vascular plant species within designated 0.04ha areas, with each species attributed a cover abundance code (see Wilson *et al* 1997 or NPWS 2000 for further details). Such techniques are identical to those used during the LHCCREMS regional study.

Where possible, additional standard floristic survey plots were established to add to the body of knowledge being collected in the region, using the same techniques as

described above. Areas heavily degraded or infested with weed species are generally not suited to such survey, and are more economically surveyed by foot traverses.

5.0 RESULTS

5.1 Mapping of Vegetation Communities

Vegetation communities present within the study area have been preliminarily determined within a LHCCREMS framework, although further ground truthing is required.

Those identified include:

- Seaham/ Lower Hunter Spotted Gum – Ironbark Forest Intergrade (MU's 16 & 17, coded here as MU16/17)
- Hunter Lowlands Redgum Forest (MU 19)
- Disturbed Freshwater Wetland Complex (MU46, coded here as Xw)

Remapping of the study area has allowed the spatial depiction of vegetation to a higher resolution than has been previously attempted at Thornton North. Figure 2 shows the revised vegetation map for the area. Further details relating to each of these communities, as they occur on the Thornton North site, is found in Section 6.1.

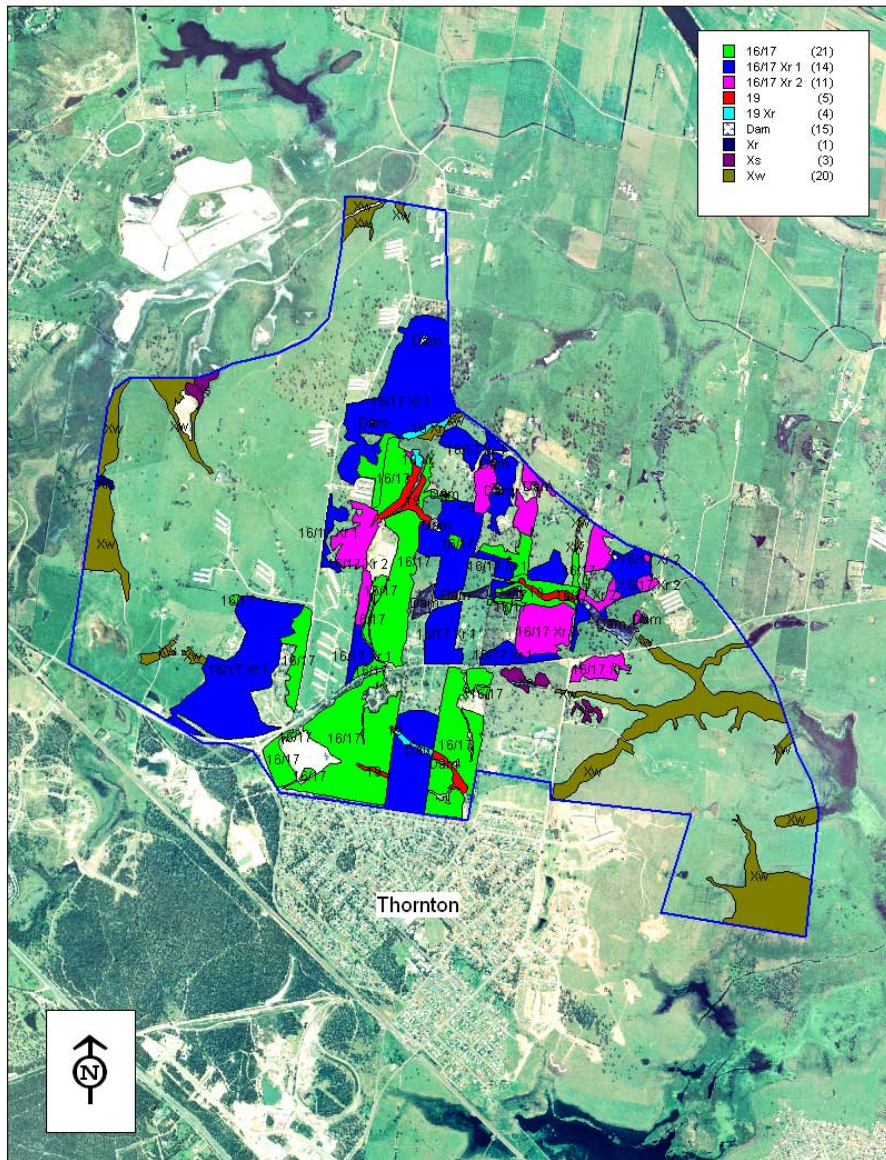


Figure 2 Vegetation communities and condition of the Thornton North study area.

Much of the areas previously modelled by NPWS (as revised by Eco Logical 2002) on the site included areas with varying levels of vegetation condition. These range from locations containing no canopy trees (regrowth) to those supporting only canopy trees over modified agricultural landscapes. As a consequence, the remapping of the study area is necessary to apply conditional tags to each polygon, which will assist in assessing conservation priorities. Unmapped areas generally support cleared or highly modified landscapes, where very widely scattered canopy trees may be present. Some portions of the study area supporting relatively undisturbed vegetation have been invaded by

Lantana camara, where it forms impenetrable thickets. Wherever possible, remnant canopy tree species have been used to distribute disturbed categories (Xr 1 & Xr 2) to appropriate vegetation communities (eg: 16/17 Xr 1).

5.2 Vegetation Survey

Field reconnaissance of the vegetation present within the study area was undertaken over a period of two days in March and April 2003. The perimeter and all public access roads of the area were traversed to obtain a thorough overview of the vegetation present, and to assist in ground truthing of vegetation mapping. In addition, several foot traverses were made onto private properties (with owners consent) recording plant species, vegetation condition and noting trends in community distribution. At two locations within the study area (both on land owned by PGH), vegetation condition was considered adequate for detailed sampling plots to be censused, following standard techniques used during the LHCCREMS process (NPWS 2000).

Over one hundred plant species were recorded during the survey (Appendix 1), although none are currently listed as rare or threatened in New South Wales or Nationally. Specimens of Forest Redgum (*Eucalyptus tereticornis*) growing along some creeklines possibly include some genes of the vulnerable Slaty Redgum (*Eucalyptus glaucina*), as individuals showing decidedly glaucous foliage, strongly angled branchlets and generally more robust habits were noted. However, the absence of glaucous buds and differing fruit shape were considered sufficiently distinct from specimens of *Eucalyptus glaucina* collected by the author from the Singleton area (Bell 2003) and near Cessnock (Bell 2001; unpubl. data). Brooker *et al.* (2002) recognise the hybridisation that does occur between these two redgum species, and the lack of glaucous bud material would indicate that *Eucalyptus tereticornis* is the dominant genotype at Thornton North.

6.0 DISCUSSION

6.1 LHCCREMS Modelling and the Revised Vegetation Map

It is pertinent to compare the presence and extent of vegetation communities modelled for the study area (through the LHCCREMS process) with the revised mapping undertaken in the current study. On the whole, modelling undertaken by NPWS (2000) is of an acceptable accuracy, although some latitude is required with respect to the true identity of the Spotted Gum – Ironbark forests present. Figure 3 illustrates the vegetation

communities modelled for the study area by NPWS (2000), as updated by Eco Logical (2002). Those map units present include:

- Lower Hunter Spotted Gum - Ironbark Forest (MU17)
- Freshwater Wetland Complex (MU46)
- Alluvial Tall Moist Forest (MU5)
- Swamp Mahogany - Paperbark Forest (MU37)

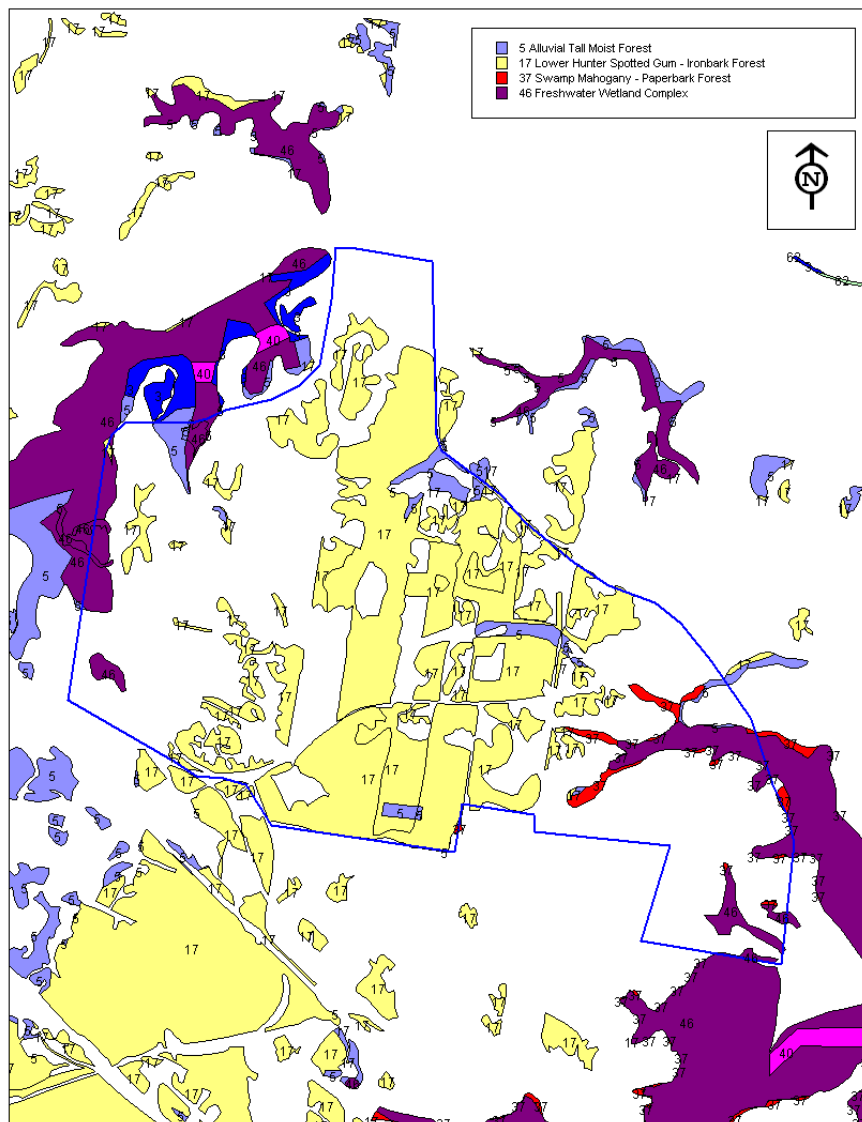


Figure 3 Vegetation communities as modelled through the LHCCREMS process for the Thornton North study area.

Specific comments on the occurrence of each of these in the study area follow, and include explanations of how each relates to the ground situation at Thornton North.

Lower Hunter Spotted Gum – Ironbark Forest (MU17)

NPWS (2000) delineated four vegetation communities within the region where Spotted Gum (*Corymbia maculata*) forms a prominent component in the overstorey. The mapping of these four communities indicated that in the Thornton area, at least three of these converge (MU’s 15, 16 & 17). As a consequence, it can be difficult to confidently separate the three without undertaking a detailed analysis of each stand of vegetation. Table 2 below attempts to identify how each of these communities can be delineated in the field, based on the canopy information provided in NPWS (2000). It is evident from this table that separation of the four relies on more than just canopy species. Consequently, elements of all four communities are present in the study area.

Table 2 Canopy presence in each of the four Spotted Gum *Corymbia maculata* communities identified by NPWS (2000) for the region. With the exception of *Eucalyptus paniculata*, species listed include only those noted as positively diagnostic by NPWS (2000) for at least one community.

Canopy Species	Map Unit 15	Map Unit 16	Map Unit 17	Map Unit 18
<i>Corymbia maculata</i>	positive	positive	positive	positive
<i>Eucalyptus fibrosa</i>	uninformative	positive	positive	uninformative
<i>Eucalyptus crebra</i>	absent	positive	uninformative	positive
<i>Eucalyptus siderophloia</i>	positive	uninformative	uninformative	absent
<i>Eucalyptus paniculata</i>	uninformative	absent	uninformative	absent
<i>Eucalyptus punctata</i>	uninformative	positive	positive	absent
<i>Eucalyptus umbra</i>	positive	absent	uninformative	absent
<i>Eucalyptus moluccana</i>	absent	uninformative	uninformative	positive

Note: Map Unit 15 = Coastal Foothills Spotted Gum – Ironbark Forest
 Map Unit 16 = Seaham Spotted Gum – Ironbark Forest
 Map Unit 17 = Lower Hunter Spotted Gum – Ironbark Forest
 Map Unit 18 = Central Hunter Spotted Gum – Ironbark Forest

Within the Thornton North study area, it is possible that the Spotted Gum forest present has closer affinities to the Seaham Spotted Gum – Ironbark Forest (MU16), although further investigation is required. Lower Hunter Spotted Gum Ironbark Forest (MU17) is typified by *Corymbia maculata* and *Eucalyptus fibrosa*, with *Melaleuca nodosa* prominent in the

understorey. In the study area, *Eucalyptus fibrosa* appears to be very minor (at the expense of other ironbarks more typical of MU16, such as *Eucalyptus crebra* and *Eucalyptus siderophloia*), and *Melaleuca nodosa* does not appear to be present, certainly not as a dominant component. The presence of other eucalypts such as *Eucalyptus globoidea* and *Eucalyptus moluccana* also lend support to this contention. In addition, there is at least one location within the study area that supports Blackbutt (*Eucalyptus pilularis*) in an upper slope position, a feature also occurring in the Clarence Town-Karuah area within Seaham Spotted Gum – Ironbark Forest (pers. obs.). The Thornton North area may in fact be at a convergence zone between the Lower Hunter Spotted Gum – Ironbark Forest, and the Seaham Spotted Gum – Ironbark Forest, as elements of both appear to be present. Both communities have undergone comparable range reductions in the bioregion since European settlement (between 50 and 60 % loss).

NPWS (2000) describe the Lower Hunter Spotted Gum – Ironbark Forest (MU17) as being characterised by the canopy trees *Corymbia maculata* and *Eucalyptus fibrosa*, with occasional *Eucalyptus punctata* or *Eucalyptus canaliculata*, and an understorey of *Acacia parvipinnula*, *Daviesia ulicifolia*, *Melaleuca nodosa*, *Cheilanthes sieberi subsp. sieberi*, *Entolasia stricta*, *Pomax umbellata*, *Dianella revoluta var. revoluta*, *Pratia purpurascens*, *Themeda australis*, and *Phyllanthus hirtellus*. They note that the forests between Cessnock and Beresfield form the core distribution of this vegetation type. Reservation of this community is known only from Werakata National Park near Cessnock (Bell 2001), where approximately 1600ha occurs. Regionally, Lower Hunter Spotted Gum – Ironbark Forest is also listed on the register of significant vascular plants, populations and ecological communities maintained by the Hunter Region Botanic Gardens (Bell *et al.* 2003). As such, it is recognised as a community of regional significance which may over time qualify for legal protection under the relevant threatened species legislation.

Freshwater Wetland Complex (MU46)

NPWS (2000) have mapped extensive areas of the Hunter River floodplain in the vicinity of Thornton North as supporting Freshwater Wetland Complex. This complex is described as supporting a characteristically dense ground layer of rushes, sedges and aquatic plants. Viewing of digital aerial photographs and limited ground truthing indicates that areas mapped as this unit within the study area are highly degraded and subject to frequent

grazing and pasture improvements. It is unlikely that any undisturbed examples of this community remain there.

Alluvial Tall Moist Forest (MU5)

A few narrow bands of Alluvial Tall Moist Forest have been modelled within the study area by NPWS (2000). These occur principally along drainage lines, and are intended to support vegetation where *Eucalyptus saligna*, *Syncarpia glomulifera* and *Glochidion ferdinandi* are characteristic above a moist, mesophytic understorey. Within the context of the Hunter River floodplain, it is unlikely that vegetation such as this occurs. It is noted, however, that NPWS (2000) mention in their description for Alluvial Tall Moist Forest that on the Williams River *Eucalyptus grandis* replaces *Eucalyptus saligna*, and that where alluvial valleys fan outward, *Eucalyptus tereticornis* becomes dominant. Observations of the Thornton North study area revealed that in most cases areas mapped as MU5 are in fact Hunter Lowlands Redgum Forest (MU19), or degraded forms of that community, a TSC Act listed Endangered Ecological Community.

Swamp Mahogany – Paperbark Forest (MU37)

At the head waters of the major wetland in the south-east of the study area, NPWS (2000) have mapped a few narrow bands of Swamp Mahogany – Paperbark Forest. These bands occur within a larger area of cleared agricultural lands, and currently support a modified understorey subject to weed invasion and grazing. It is unlikely that Swamp Mahogany vegetation has existed there for a very long time, if at all. No Swamp Mahogany (*Eucalyptus robusta*) or relevant paperbarks (*Melaleuca quinquenervia*, *M. linariifolia*, *M. biconvexa*) have been observed anywhere in the study area to date.

6.2 Vegetation Condition

Relatively little of the mapped vegetative cover in the study area can be considered of high quality. A long history of grazing and other agricultural activities in this part of the Hunter Valley has ensured that understorey vegetation in particular has been moderately-to-heavily disturbed. Canopy cover varies from completely cleared to undisturbed, although very little of the latter remains. That which does occur within the buffer zones of existing clay quarries, and is considered of high significance regionally. Weed species are

generally prevalent across the study area, with thickets of almost impenetrable Lantana occurring in some parts, such as within the buffer lands of existing quarries.

7.0 CONSERVATION ASSESSMENT

The assessment of conservation issues with regard to the Thornton North study area has been undertaken within the following framework:

- vegetation community significance, including consideration of the LHCCREMS mapping and associated conservation assessments;
- condition of the remaining vegetation, with regard to representativeness in conservation reserves and future management;
- existing and potential linkages within the local area and region;
- presence of threatened or rare plant species, or other regionally significant species;
- presence of Endangered Ecological Communities, or other regionally significant vegetation.

7.1 Vegetation Communities

In recent years there has been much debate over how to classify and prioritise ecosystems and vegetation communities, spurred on by the legal requirements of the various State and Federal Acts. Landsberg (2000) has prepared draft guidelines for the assessment of endangered ecological communities in Australia. These guidelines are intended to assist the nomination of endangered ecological communities for the Commonwealth *Environmental Protection and Biodiversity Act 1999*, and are also likely to apply to the NSW *Threatened Species Conservation Act 1995*. A number of criteria are included which determine the conservation threat of a particular community based on certain distributional traits.

In addition, other schemes have been put forward by English and Blyth (1999), and Benson and Ashby (2000). Table 1 presents a matrix showing the relationship between the *natural* rarity of a community, and its conservation status for the threat codes delineated by Benson and Ashby (2000). This matrix clearly defines the difference between those

communities that are naturally uncommon or restricted, and those that are currently restricted due to clearing.

Threat Code	Natural rarity of community		
	Common (>10000 ha at time of European Settlement)	Naturally restricted (1000ha - 10000ha)	Rare (<1000ha)
Critically endangered	>90%	>80%	>70%
Endangered	70-90%	60-80%	50-70%
Vulnerable	50-70%	40-60%	30-50%
Near threatened	35-50%	25-40%	15-30%
Least concern	<35%	<25%	<15%

Eco Logical Pty Ltd (2002) have indicated that in the revised map layer for the REMS area, 6692ha of Seaham Spotted Gum – Ironbark Forest remains in the region, a reduction of **55%** from pre-1750 estimates for substantially unmodified vegetation. This compares with 27607ha and 58% for the Lower Hunter Spotted Gum – Ironbark Forest. Both have therefore undergone comparable range reductions at the hands of Europeans.

The rumoured nomination of Lower Hunter Spotted Gum – Ironbark Forest for listing on the TSC Act is based on the initial estimates of loss for this community by NPWS (2000). A loss value of 59% was calculated, which met the Commonwealth draft criteria for potential listing as Vulnerable due to range reduction. The revised map layer produced by Eco Logical Pty Ltd (2002) calculates a loss of 58%. Under the Benson and Ashby (2000) scheme, both the Lower Hunter Spotted Gum – Ironbark Forest and Seaham Spotted Gum – Ironbark Forest would classify as **vulnerable** (both exceed 10000ha in pre-1750 estimates, and have undergone a 50-70% loss in distribution regionally). There is currently no indication that the Seaham Spotted Gum – Ironbark Forest is to be nominated as an EEC, at least until investigation is undertaken as to its extent outside of the LHCC region to the north.

7.2 Vegetation Condition

Due to a long history of European occupation in the Hunter Valley, much of the remaining vegetation on the valley floor and Hunter River floodplain has been highly modified from its original state. Parts of the study area currently under mining leases have apparently remained ungrazed and unlogged for a considerable length of time, but field inspection suggests that at least some minor logging has occurred, and the level of weed infestation

(particularly Lantana) indicates past grazing activity. Never-the-less, these relatively undisturbed examples of vegetation are rare in the region.

7.3 Linkages

Remnant native vegetation within the study area occurs at the northern end of a major linkage in the region. To the immediate north, however, the highly modified Hunter River floodplain supports almost no sizeable areas of native vegetation. There is a distance of some 7km from the Thornton North study area to the closest patch of remnant vegetation greater than 10ha in size, in a northerly, north-easterly and north-westerly direction (see Figure 4).

Draft regional corridors identified as part of the conservation assessment for the LHHCCREMS regional biodiversity strategy do not include the Thornton North area within any of their proposed linkages (LHCCREMS 2002). In addition, key habitats and corridors mapping undertaken by the NPWS also fall short of connecting both sides of the Hunter River at this point (NPWS 2003). As alluded to above, the lack of sizeable core bushland areas in this locality is likely to be the primary reason for this, and the 7km expanse with little or no vegetative cover to the north contributes nothing to any potential linkage in that area. Consequently, from a habitat linkage point of view, the Thornton North area is not considered to be of regional conservation significance for any movement of biodiversity.

7.4 Significant Plant Species

No plant species currently listed as Endangered or Vulnerable on the NSW *TSC Act 1995* have been recorded within the study area (but see discussion on *Eucalyptus glaucina* in Section 5.2). A search of the NPWS Wildlife Atlas database (March 2003) reveals no threatened species records within a 5km radius of the site.

A search of the register of regionally significant plants in the Hunter Catchment (January 2003 version; Bell *et al.* 2003) did not reveal any other plant species in the study area considered of regional significance.

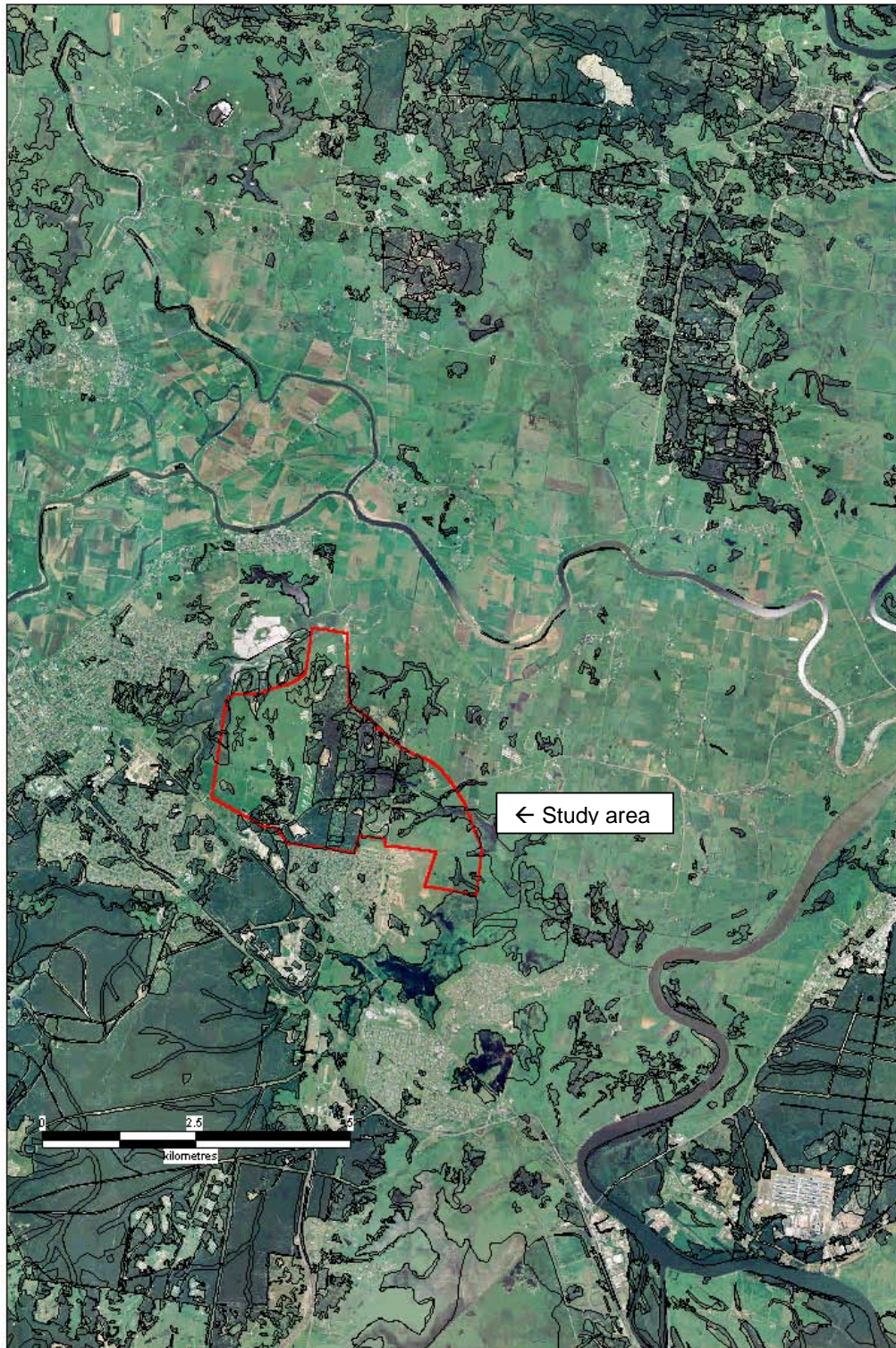


Figure 4 Location of the Thornton North study area within the context of regional extant vegetation, showing its position at the northern end of a substantial vegetation remnant south of Maitland (arrow). Linework

represents extant vegetation as mapped through the LHCCREMS project (Eco Logical 2002).

7.5 Endangered Ecological Communities

As discussed in Section 5.1, the vast majority of the study area supports Seaham/ Lower Hunter Spotted Gum – Ironbark Forest. There is currently no listing of this community within Part 3 of Schedule 1 of the NSW *Threatened Species Conservation Act 1995*. However, it is understood that a nomination has been made to list the Lower Hunter Spotted Gum – Ironbark Forest as an EEC, and this community is recognised as being of regional importance (Bell *et al.* 2003). While it may be argued that the Seaham Spotted Gum Ironbark Forest is potentially threatened in the region, it is unknown how far north of the LHCC bioregion it extends, as no comparable community could be determined in the forest ecosystem mapping of NPWS (1999).

Some gully lines within the Thornton North study area do support the Hunter Lowlands Redgum Forest EEC, in places mapped by NPWS (2000) as Alluvial Tall Moist Forest. Some such areas are highly modified, with only emergent Forest Redgum (*Eucalyptus tereticornis*) occurring over improved pastures. No Hunter Lowlands Redgum Forest was modelled for the study area by NPWS (2000). This vegetation type is poorly conserved in the region, and has historically been subjected to clearing for agriculture. Werakata National Park supports approximately 7ha (Bell 2001), but no other conservation reserve in the bioregion has been confirmed as containing this vegetation type. Any impact imposed on this vegetation due to a proposed development activity would require the completion of an eight part test under the *Environmental Planning & Assessment Act 1979*, as amended by the *Threatened Species Conservation Act 1995*.

8.0 RECOMMENDATIONS

As a result of the vegetation investigations reported on here, it is recommended that:

- **vegetation retention** – those areas found to support Hunter Lowlands Redgum Forest (MU17), and relatively good quality native vegetation free from major disturbance, and including some structural diversity, be retained to assist in the regional conservation of severely depleted valley floor communities;
- **rehabilitation** – due to the linear nature of such areas mentioned above, linking areas supporting disturbed vegetation should be rehabilitated to further enhance the role in regional conservation of the nominated good quality remnants.

Figure 5 illustrates these recommended constraints, which can be summarised as follows:

- 1 **Very High** value conservation areas. These are essentially the areas Hunter Lowlands Redgum Forest EEC, and include the *Eucalyptus tereticornis - glaucina* hybrids.
- 2 **High** value conservation areas. Areas acting as buffers around the EEC, but also reasonably good quality Spotted Gum-Ironbark Forest which has not been underscrubbed or intensely grazed.
- 3 **Moderate** value conservation areas. These are essentially those areas where underscrubbing and grazing has occurred to some degree, although canopy retention is high and therefore fauna habitat and corridor use could be expected to be high. Also included here are small remnants of good quality vegetation otherwise included in 2, but because of their position relative to larger stands of extant vegetation, are of lesser importance.
- 4 **Low** value conservation areas. Generally grazing lands with reduced canopy retention and moderate to severe understorey modification, usually involving improved pastures. Areas marked “4a” lie in good positions to be rehabilitated to improve the value of adjacent areas, while those marked “4b” are not.

The remaining areas of the study area are mostly cleared and therefore of little-to-no conservation value from a vegetation point of view.

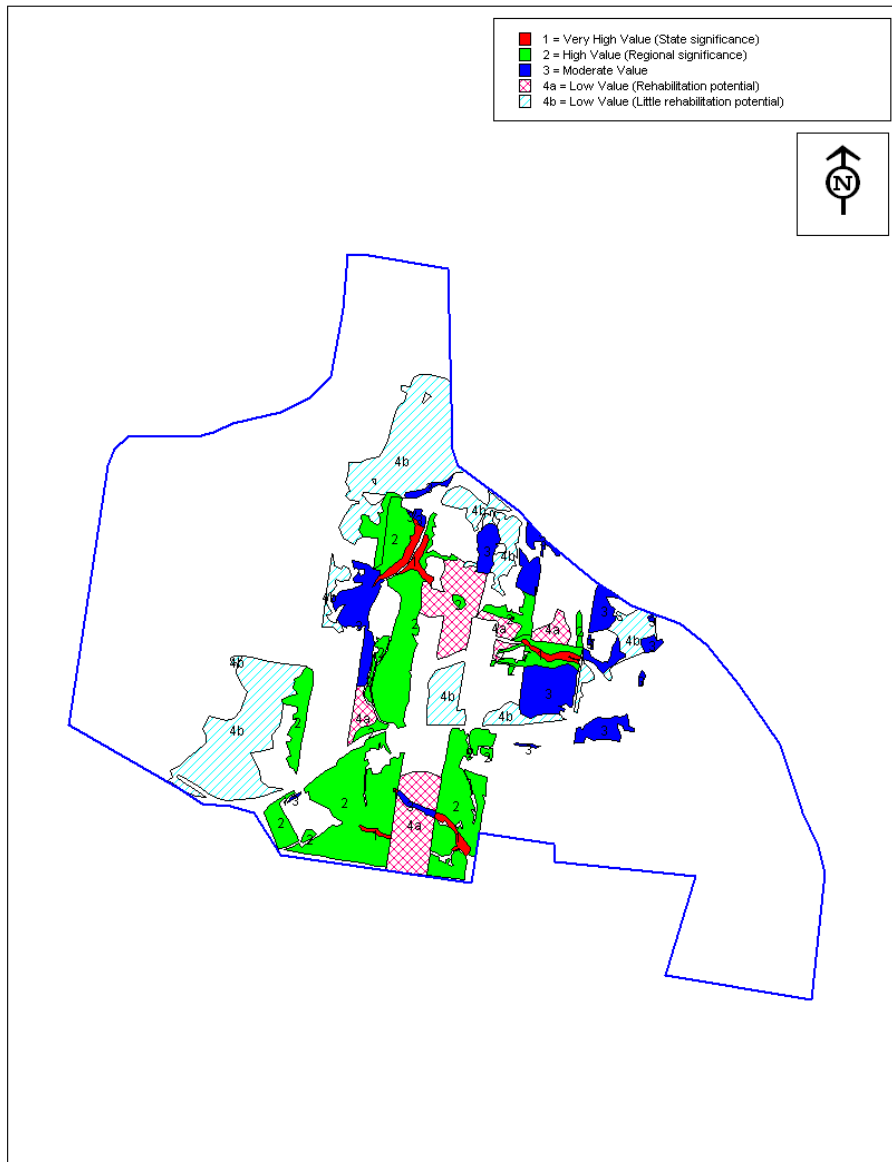


Figure 5 Vegetation constraints for the Thornton North study area.

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Appendix 1 – Plant species list

Species included are those recorded on-site during field investigations, amended with data provided by Lisa Hill from two survey plots undertaken in the south of the study area.

FAMILY	GENUS & SPECIES
CLASS FILICOPSIDA (Ferns)	
Adiantaceae	<i>Adiantum aethiopicum</i>
Sinopteridaceae	<i>Cheilanthes austrotenuifolia</i> <i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>
CLASS MAGNOLIOPSIDA (Flowering Plants) Sub-class Magnoliidae (Dicotyledons)	
Acanthaceae	<i>Brunoniella australis</i> <i>Pseuderanthemum variabile</i>
Apiaceae	<i>Centella asiatica</i> <i>Hydrocotyle peduncularis</i>
Apocynaceae	<i>Parsonsia straminea</i>
Asteraceae	<i>Ageratina adenophora</i> * <i>Bidens pilosa</i> * <i>Brachycome multifida</i> var. <i>multifida</i> <i>Cassinia arcuata</i> <i>Cassinia uncata</i> <i>Chrysocephalum apiculatum</i> <i>Epaltes australis</i> <i>Laginifera stipitata</i> <i>Vernonia cinerea</i> var. <i>cinerea</i>
Cactaceae	<i>Opuntia stricta</i> *
Campanulaceae	<i>Wahlenbergia communis</i>
Casuarinaceae	<i>Allocasuarina torulosa</i>
Chenopodiaceae	<i>Einadia hastata</i> <i>Einadia linifolia</i>
Convolvulaceae	<i>Dichondra repens</i>
Epacridaceae	<i>Leucopogon juniperinus</i>
Euphorbiaceae	<i>Glochidion ferdinandi</i> var. <i>ferdinandi</i>

Fabaceae: Faboideae	<i>Daviesia ulicifolia</i> <i>Desmodium brachypodum</i> <i>Desmodium rhytidophyllum</i> <i>Dillwynia retorta</i> <i>Glycine clandestina</i> <i>Glycine tabacina</i> <i>Hardenbergia violacea</i> <i>Pultenaea cunninghamii</i> <i>Pultenaea villosa</i>
Fabaceae: Mimosoideae	<i>Acacia elongata</i> <i>Acacia falcata</i> <i>Acacia irrorata</i> subsp. <i>irrorata</i> <i>Acacia longifolia</i> <i>Acacia stricta</i> <i>Acacia ulicifolia</i>
Goodeniaceae	<i>Goodenia hederacea</i> subsp. <i>hederacea</i> <i>Goodenia rotundifolia</i>
Haloragaceae	<i>Gonocarpus tetragynus</i>
Lobeliaceae	<i>Pratia purpurascens</i>
Loranthaceae	<i>Dendrophoe vitellina</i>
Malvaceae	<i>Sida rhombifolia</i> *
Moraceae	<i>Ficus rubiginosa</i>
Myoporaceae	<i>Eremophila debilis</i>
Myrtaceae	<i>Angophora costata</i> <i>Callistemon linearis</i> <i>Corymbia gummifera</i> <i>Corymbia maculata</i> <i>Eucalyptus acmenoides</i> <i>Eucalyptus amplifolia</i> subsp. <i>amplifolia</i> <i>Eucalyptus canaliculata</i> <i>Eucalyptus crebra</i> <i>Eucalyptus fibrosa</i> <i>Eucalyptus globoidea</i> <i>Eucalyptus moluccana</i> <i>Eucalyptus pilularis</i> <i>Eucalyptus punctata</i> X <i>canaliculata</i> <i>Eucalyptus siderophloia</i> <i>Eucalyptus tereticornis</i> <i>Melaleuca linariifolia</i> <i>Melaleuca styphelioides</i>
Oleaceae	<i>Notelaea longifolia</i> forma <i>longifolia</i>

Oxalidaceae	<i>Oxalis perennans</i>
Pittosporaceae	<i>Bursaria spinosa</i> subsp. <i>spinosa</i> <i>Pittosporum undulatum</i>
Polygonaceae	<i>Persicaria orientalis</i>
Proteaceae	<i>Hakea sericea</i>
Rhamnaceae	<i>Alphitonia excelsa</i>
Rubiaceae	<i>Opercularia hispida</i>
Santalaceae	<i>Leptomeria acida</i>
Solanaceae	<i>Solanum prinophyllum</i>
Verbenaceae	<i>Verbena brasiliensis</i> *
Vitaceae	<i>Cayratia clematidea</i>

CLASS MAGNOLIOPSIDA (Flowering Plants)
Sub-class Liliidae (Monocotyledons)

Anthericaceae	<i>Arthropodium milleflorum</i>
Commelinaceae	<i>Commelina cyanea</i>
Cyperaceae	<i>Carex</i> sp. <i>Carex appressa</i>
Juncaceae	<i>Juncus usitatus</i>
Lomandraceae	<i>Lomandra confertifolia</i> subsp. <i>pallida</i> <i>Lomandra filiformis</i> subsp. <i>filiformis</i> <i>Lomandra longifolia</i> <i>Lomandra multiflora</i> subsp. <i>multiflora</i>
Phormiaceae	<i>Dianella revoluta</i> var. <i>?vinosa</i> <i>Dianella revoluta</i> var. <i>revoluta</i> <i>Dianella tasmanica</i>
Poaceae	<i>Aristida ramosa</i> <i>Aristida vagans</i> <i>Bothriochloa macra</i> <i>Briza maxima</i> * <i>Cynodon dactylon</i> * <i>Dichelachne micrantha</i> <i>Echinopogon caespitosus</i> var. <i>caespitosus</i>

Echinopogon ovatus
Ehrharta erecta *
Entolasia stricta
Imperata cylindrica var. *major*
Microlaena stipoides var. *stipoides*
Panicum effusum
Panicum simile
Paspalum dilatatum *
Paspalum orbiculare
Poa affinis
Poa labillardierei var. *labillardierei*
Setaria gracilis
Themeda australis
