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Australian Government

National Recovery Plan
Weeping Myall – Coobah – Scrub Wilga Shrubland of the Hunter Valley

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Office of Environment and Heritage NSW
59 Goulburn Street, Sydney NSW 2000
PO Box A290, Sydney South NSW 1232
Phone: (02) 9995 5000 (switchboard)
Phone: 131 555 (environment information and publications requests)
Phone: 1300 361 967 (national parks, climate change and energy efficiency information, and publications requests)
Fax: (02) 9995 5999
TTY: (02) 9211 4723
Email: info@environment.nsw.gov.au
Website: www.environment.nsw.gov.au

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Cover photographer: Tricia Hogbin

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1. Introduction

Weeping Myall – Coobah – Scrub Wilga Shrubland of the Hunter Valley is listed as a critically endangered ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The related Hunter Valley Weeping Myall Woodland is listed as an endangered ecological community on Schedule 1 of the NSW *Threatened Species Conservation Act 1995* (TSC Act). These two closely related ecological communities provide habitat for the endangered Weeping Myall population in the Hunter catchment which is listed on Schedule 1 of the TSC Act.

Due to their close relationship (see section 2.1), these three threatened entities are herein considered to be synonymous, unless indicated otherwise, and within this plan are referred to as Hunter Valley Weeping Myall[1].

Hunter Valley Weeping Myall is restricted to the mid and upper Hunter Valley, New South Wales. Given the extensive vegetation clearing that has occurred across this region for agriculture and mining, there are only 43 naturally occurring populations of Hunter Valley Weeping Myall known across the valley. These populations consist of 102 small, isolated and highly degraded remnants. Vegetation clearing continues to be the main threat to the persistence of Hunter Valley Weeping Myall.

This document constitutes the national recovery plan for Hunter Valley Weeping Myall and, as such, considers the requirements of the entity across its known range. It identifies the actions to be taken to ensure the long-term viability of the entity in nature, and the parties who will undertake these actions.

This plan has been prepared by the Office of Environment and Heritage, Department of Premier and Cabinet NSW (OEH) in consultation with the Hunter Valley Threatened Flora Recovery Team. The development of this plan was greatly assisted by Travis Peake and Liza Hill of Umwelt Environmental Consultants who, on behalf of OEH, documented information on the taxonomy, distribution, habitat and ecology of Hunter Valley Weeping Myall (Umwelt 2006a). Preliminary taxonomic research undertaken by Stephen Bell (Bell 2006, 2007) also greatly assisted in the development of this plan.

2. Biological Information

2.1 Taxonomy and description

This recovery plan covers three related threatened entities:

- Weeping Myall – Coobah – Scrub Wilga Shrubland of the Hunter Valley which is listed as a critically endangered ecological community (CEEC) under the EPBC Act 1999
- Hunter Valley Weeping Myall Woodland which is listed as an endangered ecological community (EEC) on Schedule 1 of the TSC Act
- Weeping Myall in the Hunter catchment which is listed as an endangered population on Schedule 1 of the TSC Act.

A discussion of these three entities and their relationship follows.

[1] The term 'Hunter Valley Weeping Myall' (HVWM) refers to and includes three threatened entities: the EPBC Act–listed critically endangered ecological community Weeping Myall – Coobah – Scrub Wilga Shrubland of the Hunter Valley; the TSC Act–listed endangered ecological community Hunter Valley Weeping Myall Woodland; and the TSC Act–listed endangered Weeping Myall population in the Hunter catchment.

2.1.1 Weeping Myall

Description

Acacia pendula Cunn. exe G. Don (Weeping Myall or Boree) is an erect or spreading small tree, 5–13 m high, with pendulous branches and leaves, and rough fissured grey bark. A detailed description of Weeping Myall can be found in Kodela and Harden (2002) (available online at <http://plantnet.rbgsyd.nsw.gov.au/>).

Weeping Myall is widespread across inland Queensland, New South Wales and Victoria, with a few records in eastern South Australia, the Hunter populations being the eastern distributional limit of the species (Kodela & Harden 2002).

Taxonomy and differentiating from similar species

Weeping Myall may be confused with the closely related trees *Acacia omalophylla* and *A. melvillei*, which occur in a similar habitat and across similar distributions (Umwelt 2006a). Taxonomically, the *Acacia pendula – melvillei – omalophylla* group is very confusing and has not been satisfactorily resolved (Bell 2007).

Reliably differentiating the taxa is strongly reliant on pod and seed characteristics. Weeping Myall can be distinguished by its narrower, winged pods (a feature absent in the other two species), and seeds which are transverse in pod (shared only with *A. melvillei*) (Bell et al. 2007).

Other non-seed characters can be variable and are not typically reliable for identification. For example, Weeping Myall is widely regarded as having a pendulous habit and this habit is most commonly used in identification (Bell 2007). However, for *A*. *melvillei* and *A. omalophylla* (and many other arid zone acacias), the pendulous tendency is also a feature. It has also been noted by Bell (2007) and Umwelt (2006a) that young plants of Weeping Myall are not pendulous, but acquire a pendulous habit when approximately 2 m high. The pubescent (hairy) phyllodes of Weeping Myall are also commonly used to differentiate the species. However, as discussed in Bell (2007), hair length appears to be a continuous character which is not reliable for use in identification.

Morphological differences within the Hunter Valley population

Recent investigations have revealed ambiguities in the morphology of Weeping Myall in the Hunter, with possible taxonomic implications (Umwelt 2006a; Bell 2006, 2007; Bell et al. 2007). The morphology of what has traditionally been accepted as Weeping Myall varies, with recognition of two morphological forms: a pendulous form and a non-pendulous form. Unfortunately, positive identification of Weeping Myall within the Hunter has been difficult due to the lack of fruiting material, critical in distinguishing this species from *A. melvillei* and *A. omalophylla.*

The pendulous form is considered typical of the taxon, with gracefully pendulous grey-green foliage on single-stemmed individuals. This form is very rare in the Hunter and appears to be restricted to four plantings and as few as five of the 43 naturally occurring populations.

The non-pendulous form is considerably more widespread, and is typified by non-pendulous yellowish grey-green foliage and vigorous root suckering.

Interestingly, vegetation at Jerrys Plains Cemetery, the site listed in both New South Wales and Commonwealth threatened species legislation as supporting Weeping Myall, supports both the non-pendulous and pendulous forms. Specimens from this and other sites have been sent to the National Herbarium of New South Wales for identification. Specimens of both forms from Jerrys Plains Cemetery were identified as Weeping Myall (Umwelt 2006b), whereas a non-pendulous specimen from Wambo Coal Mine, near Warkworth, was subsequently given an inconclusive identification due to the lack of fruiting material (Bell 2007). At present, given available information, both the pendulous and non-pendulous forms within the Hunter Valley are considered Weeping Myall.

In accordance with IUCN guidelines (IUCN Standards and Petitions Subcommittee 2013), sub-populations or individual trees of either form of Weeping Myall that have been planted and show

evidence of natural recruitment (i.e. are self-sustaining) should also be considered part of the threatened Hunter Valley Weeping Myall population.

Further discussion of the morphology and taxonomy of the Hunter Valley population of Weeping Myall can be found in Bell (2007) and Bell et al. (2007).

2.1.2 Hunter Valley Weeping Myall Woodland

Hunter Valley Weeping Myall Woodland is typically a mid-high (to 15 m) open forest or woodland with a dense to mid-dense canopy dominated by Weeping Myall (Umwelt 2006a). In disturbed sites the community is typically highly simplified, with Weeping Myall occurring as scattered trees or tree-clumps over a sparse to absent understorey comprising few native species. Most remnants of the community in the Hunter Valley are of this form. They are generally small, consist mostly of regrowth trees, and are grazed or affected by other severe disturbance to the ground cover.

In two sites which have been less affected by disturbances, the community is more structurally and floristically diverse. These sites occur at Jerrys Plains Cemetery and Wambo Coal Mine, near Warkworth.

The best known example of the woodland occurs at Jerrys Plains Cemetery where grazing by domestic stock has been limited. At Jerrys Plains Cemetery, the canopy is dominated by Weeping Myall, Yarran (*A. melvillei – omalophylla*)[2] and Cooba (*A. salicina*) (Umwelt 2006a, 2006b). A well-developed shrub stratum occurs with Sticky Hopbush (*Dodonaea viscosa*), Canthium (*Psydrax odorata*, synonym *Canthium buxifoliu*m), Native Olive (*Notelaea microcarpa* var. *microcarpa*), Bead Bush (*Spartothamnella juncea*), Silver Cassia (*Senna artemisioides* subsp*. zygophylla*), Brush Wilga (*Geijera salicifolia*) and Wilga (*Geijera parviflora*). The dense ground cover of native grasses and forbs includes Wallaby Grass (*Rytidosperma fulvum*), Kangaroo Grass (*Themeda triandra* syn. *T. australis*), Common Everlasting (*Chrysocephalum apiculatum*), Climbing Saltbush (*Einadia nutans* subsp. *nutans*), Eastern Saltbush (*Maireana microphylla*), Ruby Saltbush (*Enchylaena tomentosa*), *Ptilotus nobilis* subsp. *semilanatus* and Barbed Wire Grass (*Cymbopogon refractus*).

Several of the characteristic species of the community occurring at Jerrys Plains Cemetery also occur at Wambo Coal Mine (Umwelt 2006a). However, a history of more intense grazing at the mine site has resulted in a lower floristic diversity and sparser understorey. This site was fenced in early 2006 and with supportive management, such as weed control, has a high likelihood of recovering over time.

Together, the Jerrys Plains Cemetery and Wambo Coal Mine remnants represent two known remnants of Hunter Valley Weeping Myall Woodland that have a reasonable degree of structural integrity and native species diversity that probably most closely resemble the community prior to European arrival in the Hunter Valley (Umwelt 2006a). The remainder of remnants within the Hunter Valley are typically characterised by mono-specific clumps of Weeping Myall over a species-depauperate understorey and ground cover.

The typically monospecific stands of Weeping Myall are recognised as Hunter Valley Weeping Myall Woodland in accordance with the final determination (NSW Scientific Committee 2006). The determination states that Hunter Valley Weeping Myall Woodland occurs within a region in which native vegetation has been extensively cleared and persists only as very small remnants of less than one hectare, or as isolated trees. The determination states that the number and relative abundance of diagnostic species present may vary depending on influences such as size of the site, recent rainfall, and disturbances (e.g. grazing, flooding, land clearing and fire). As a result, at any one time, above-ground individuals of some species may be absent, but the

[2] *Acacia omalophylla* and *A. melvillei* are often difficult to identify without pods. The Yarran taxon at the cemetery site is currently recognised as being part of the *Acacia melvillei-omalophylla* species complex (Umwelt 2006b).

species may be represented below ground in the soil seed banks as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers.

Therefore, despite the absence of some of the species listed by NSW Scientific Committee (2006) as being characteristic of the community, populations of Weeping Myall over grazed pasture — with no or few shrubs — may harbour some diagnostic species in the form of below-ground propagules. They may have the capacity to regenerate into a more diverse ecological community, and therefore have the potential to be classified as being part of the endangered ecological community Hunter Valley Weeping Myall Woodland (Umwelt 2006a).

2.1.3 Weeping Myall – Coobah – Scrub Wilga Shrubland of the Hunter Valley

The Weeping Myall – Coobah – Scrub Wilga Shrubland of the Hunter Valley is described by the Commonwealth Threatened Species Scientific Committee (2005) as 'a woodland of Weeping Myall (*Acacia pendula*) up to 10 m high with Coobah (*Acacia salicina*) and Brush Wilga (*Geijera salicifolia*). Yarran (*Acacia omalophylla*) and Stiff Canthium (*Psydrax odorata*) are also present in the small tree/shrub layer. The ground stratum is dense and primarily grassy. Grasses include Kangaroo Grass (*Themeda triandra*), Wallaby Grass (*Rytidosperma* spp.), Snow Grass (*Poa sieberiana*) and Barbed Wire Grass (*Cymbopogon refractus*). Some exotic grasses have also invaded the site'.

The Threatened Species Scientific Committee (2005) identify Jerrys Plains Cemetery as the only known site of the community. They describe the community as 'occurring specifically in a small stand on heavy, brown clay soil at Jerry's Plains in the Hunter Valley' and state that there is only 'one patch of two hectares of the Weeping Myall – Coobah – Scrub Wilga Shrubland of the Hunter Valley ecological community remaining… The patch occurs at Jerry's Plains, including the cemetery'.

Despite the specific identification by the Threatened Species Scientific Committee (2005) of this community occurring only at the Jerrys Plains Cemetery site, the community is floristically similar to that found at Wambo Coal Mine (Umwelt 2006a; Bell 2007). Bell (2007) goes on to state that the 'Wambo stand should be considered as consistent with … the EPBC Act … endangered ecological community definition'.

2.1.4 Relationship between the three threatened entities

Most, if not all, naturally occurring stands of Weeping Myall in the Hunter Valley will form both the NSW TSC Act–listed endangered population and EEC Hunter Valley Weeping Myall Woodland (Umwelt 2006a). The absence of Weeping Myall in a floristic community does not correspond with the absence of the EEC (Umwelt 2006a).

The relationship between the NSW TSC Act–listed entities and the Commonwealth EPBC Act–listed CEEC is more complicated given that the Threatened Species Scientific Committee (2005) identify the Jerrys Plains Cemetery remnant as the only known site of the EPBC Act–listed CEEC, despite there being at least one other site that is structurally and floristically consistent with the EPBC Act CEEC definition. It is recommended that any assessment of whether a site supports the Commonwealth CEEC be undertaken on a site-specific basis.

Further discussion of the relationship between the NSW TSC Act–listed EEC and the Commonwealth listed CEEC can be found in Umwelt (2006a and b) and Bell (2007).

2.2 Distribution, abundance and land tenure

2.2.1 Current distribution

Hunter Valley Weeping Myall (Hunter Valley Weeping Myall) is restricted to the Muswellbrook, Singleton and Upper Hunter local government areas (LGAs) in the mid and upper Hunter Valley, from Broke in the south to Wybong Heights in the north (Figure 1). Hunter Valley Weeping Myall also has the potential to occur in the Cessnock LGA, although only apparently planted populations have been recorded in this LGA.

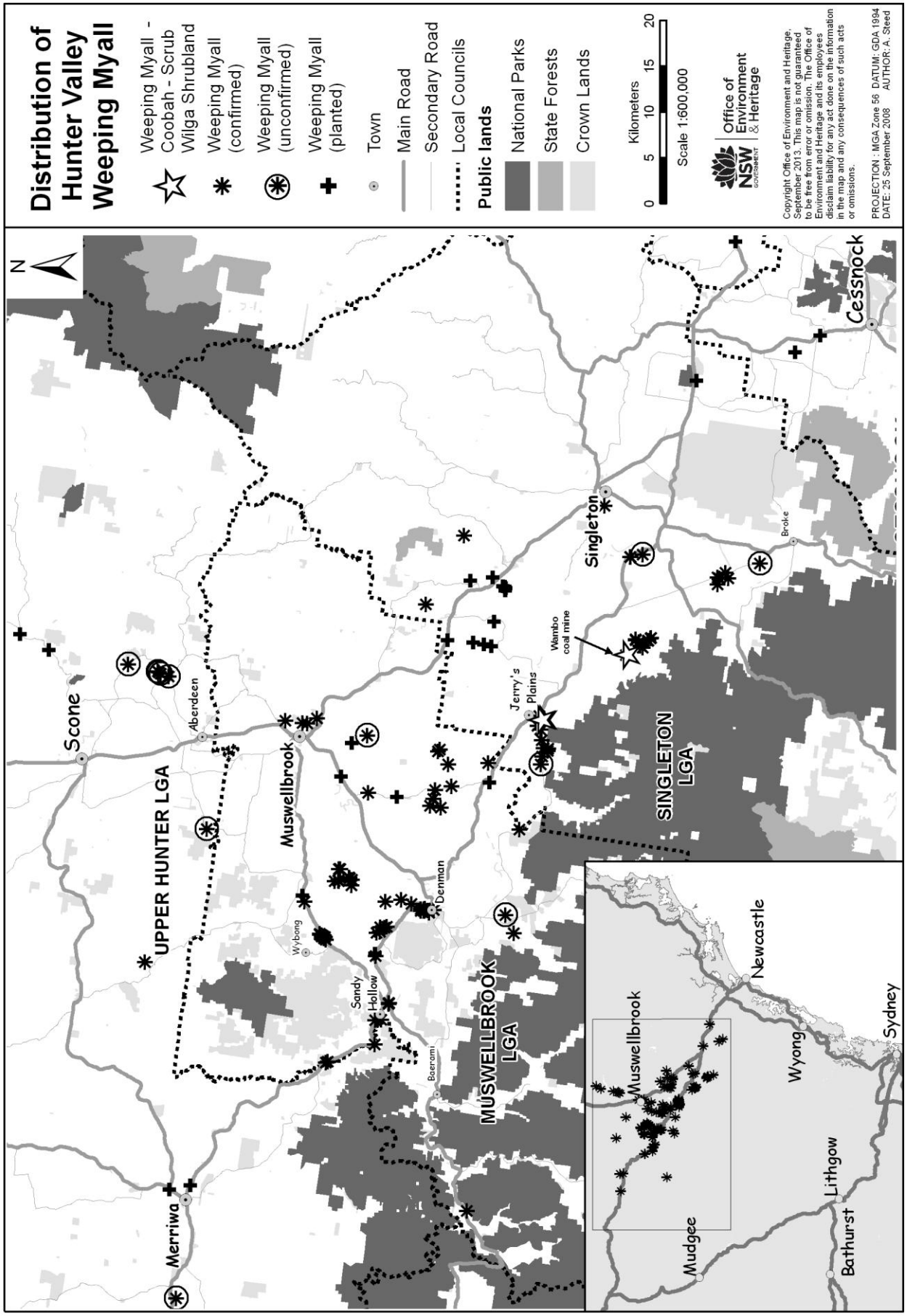

Figure 1. Weeping Myall – Coobah – Scrub Wilga Shrubland (CEEC), Hunter Valley Weeping Myall Woodland (EEC) / Weeping Myall Population (EP) locations

Hunter Valley Weeping Myall is currently known from only 43 naturally occurring populations, where a population is a group of sites within 1km of each other. These 43 populations consist of 102 sites or sub-populations, with the total area of all sites estimated to be less than 15 hectares. A further 9 locations consisting of 12 sites have been identified as possible Hunter Valley Weeping Myall populations, but have not yet been confirmed.

A further 25 sites are considered to be Hunter Valley Weeping Myall plantings. Three of these sites (two at Ravensworth and one at Thomas Mitchell Drive south of Muswellbrook) show evidence of recruitment, however it has not been determined whether juvenile plants are suckers or regeneration from seed. The other 22 sites require investigation to confirm whether they exhibit evidence of natural recruitment. Appendix 1 contains details of all known Hunter Valley Weeping Myall populations.

Five sites where Hunter Valley Weeping Myall has been recorded are likely to have been cleared for coal mining in the Anvil Hill area and at another three sites records are over 50 years old. One of the sites at Cassilis has been reported as being extant, however the location is not known and therefore has not been confirmed. These sites have not been considered further in the recovery plan. Additionally, a previous record of Hunter Valley Weeping Myall at Mount Misery near Wollar, 50km west of Denman, has been confirmed as being Brigalow (*Acacia harpophylla*) and disregarded from further consideration.

Outside of the Hunter catchment, Weeping Myall is widespread across inland areas of New South Wales (Kodela & Harden 2002) and also occurs in Victoria, Queensland and South Australia (CHAH 2008). The Hunter Valley Weeping Myall is disjunct and occurs at the eastern distributional limit of Weeping Myall (Kodela & Harden 2002).

In Figure 1, the star symbol corresponds to the locations where the EPBC Act-listed critically endangered Weeping Myall – Coobah – Scrub Wilga Shrubland of the Hunter Valley ecological community is known to occur (Jerry's Plains cemetery and Wambo coal mine). The asterisk symbol corresponds to locations where the TSC Act–listed endangered ecological community Hunter Valley Weeping Myall Woodland and the TSC Act–listed endangered Weeping Myall population in the Hunter catchment occur. The encircled asterisk sites are locations where the identification of the *Acacia* species has not yet been confirmed. The cross symbols are locations where Weeping Myall is considered to have been planted.

Outside of Jerrys Plain's and Wambo coal mine sites, site-specific assessment is needed to confirm whether any asterisk site supports the EPBC Act–listed Weeping Myall – Coobah – Scrub Wilga Shrubland of the Hunter Valley.

2.2.2 Historical distribution

Hunter Valley Weeping Myall is likely to have occurred over a significantly larger area than it is found in today. Its pre-European distribution is unknown, however, Umwelt (2006a) estimates it may have covered from 50 to 200 hectares and the Threatened Species Scientific Committee (2005) estimate it covered about 100 hectares. Given that less than 15 hectares remain, it is likely that over 70–93% of the original extent of Hunter Valley Weeping Myall has been cleared.

Prior to European arrival, Hunter Valley Weeping Myall probably occurred as relatively small patches contiguous with other native woodland, most likely Central Hunter Box – Ironbark Woodland (Peake 2006). It is likely to have formed low, open woodlands in mosaic with this community, in areas of suitable heavy loams on floodplain margins and lower slopes.

Many of the species that occur within Hunter Valley Weeping Myall, including Weeping Myall, are typical of drier inland areas and probably invaded the Hunter Valley during a period of drier, cooler conditions 23–12,000 years ago during the last glacial maximum, when much of the Hunter Valley was probably semi-arid (Story et al. 1963; Tame 1992a).

2.2.3 Population size and area

There are only 43 small, isolated and highly degraded populations of naturally occurring Hunter Valley Weeping Myall across the valley, consisting of 102 sites or sub-populations. The total number of mature Weeping Myall trees across these populations is estimated to be around

3,300. However, this number is likely to be a considerable over-estimate given the taxon's apparent vigorous clonal nature. One potential theory for the apparent absence of seed set in the Hunter Valley (see section 2.5) is that the entire Hunter Valley population comprises one or few self-incompatible clones. If this were the case, total population size could be as few as 1–43 individuals.

Of the 102 Weeping Myall naturally occurring sites, only 9 support greater than 100 Weeping Myall individuals and only 7 have an area of occupancy greater than 0.5 hectares (Table 1). The total area of all remaining Hunter Valley Weeping Myall remnants is estimated to be less than 15 hectares. Three sites of greater than 0.5 hectares are the only ones currently considered to support a community of native plants with reasonable floristic and structural diversity (Umwelt 2006a). These sites, supporting 'important populations' of *Acacia pendula* and important patches of the ecological community, occur at Jerrys Plains Cemetery, Wambo Coal Mine and Anvil Hill (Populations 10, 8 and 4 in Appendix 1). The Anvil Hill population, while not as structurally diverse as the former two and not considered to be structurally and floristically consistent with the EPBC Act CEEC definition of Weeping Myall – Coobah – Scrub Wilga Shrubland of the Hunter Valley, still supports an understorey of species characteristic to Hunter Valley Weeping Myall (Umwelt 2006a). Other larger remnants (>1 ha) recorded since 2006 require further investigation to determine their floristic and structural diversity. The other known remnants of Hunter Valley Weeping Myall that are very small in size are likely to have low native plant diversity and a highly simplified structure.

Table 1. Current size class distribution based on (a) number of mature Weeping Myall individuals and (b) area of occupancy for sites supporting Hunter Valley Weeping Myall

(a)

Number of mature individuals	Number of sites
≤ 20	78
21 - 50	11
51 -100	4
101 - 200	4
≥ 201	5

(b)

Area of occupancy (hectares)	Number of sites
≤ 0.5	96
0.51 - 1	1
1.01 - 2	0
2.1 - 5	6

2.3 Land tenure

2.3.1 Land tenure

Most natural remnants of Hunter Valley Weeping Myall occur on private land, with 78 of the 102 sites occurring on private property (Table 2).The majority of these occur on agricultural land, with about 15 occurring within lands managed by various coal mining companies. Five sites occur along railway line easements on land managed by RailCorp.

Seventeen sites occur along council-managed road verges (Singleton - 5 and Muswellbrook - 12), and two sites at the Jerrys Plains Cemetery site on community land managed by Singleton Council. Ten sites occur on land that has been offset to compensate for habitat loss from major developments.

One unconfirmed, but likely extant, population occurs on land that may be a travelling stock reserve. This site, which occurs west of Merriwa, requires field survey for verification and assessment (Umwelt 2006a). Eight of the other 11 unconfirmed sites are on private agricultural lands, two on coal mining company managed land and one is on development offset lands.

Table 2. Land tenure and land managers for all confirmed naturally occurring Hunter Valley Weeping Myall remnants

Land manager	Public authority	Various landholders	Various coal mining companies	Number of sites
Freehold property		53	15	**68**
RailCorp		5		**5**
Development Offset		10		**10**
Road verge - Muswellbrook Council	12			**12**
Road verge - Singleton Council	5			**5**
Singleton Council	2			**2**
Total	**19**	**68**	**15**	**102**

2.3.2 Adequacy of representation in conservation reserves

Hunter Valley Weeping Myall is not adequately represented within conservation reserves, with no individuals or potential habitat occurring within any formal conservation reserves.

2.4 Habitat

Weeping Myall generally grows on major river floodplains on heavy clay soils, sometimes as the dominant species (Kodela & Harden 2002). Within the Hunter catchment, Hunter Valley Weeping Myall typically occurs on heavy soils, sometimes at the margins of small floodplains but also in more undulating locations remote from floodplains, such as at Jerrys Plains.

Most remnants/populations occur in areas that are not grazed or are infrequently grazed, such as roadsides, cemeteries and in railway easements.

Hunter Valley Weeping Myall does not currently occur with other associated native woodlands, as it may have before European arrival in the Hunter, due to the extensive clearing of the central Hunter Valley (Peake 2006). It is likely that Hunter Valley Weeping Myall was once strongly associated with Central Hunter Box – Ironbark Woodland (Peake 2006), and formed a community complex with it.

2.4.1 Habitat critical to survival

Habitat critical to the survival of Hunter Valley Weeping Myall includes the area of occupancy of any stand supporting a community of native plants with reasonable floristic and structural diversity. Currently known sites include sites at Jerrys Plains Cemetery, Wambo Coal Mine and at Anvil Hill.

2.5 Life history and ecology

2.5.1 Life history

Weeping Myall is likely to be a long-lived tree, with estimates that some of the older trees in the Hunter Valley may be 100 or more years old (Umwelt 2006a). Adult trees growing at the Jerrys Plains Cemetery remnant are about 55+ years old, based on aerial photographic records of the site which show it was largely cleared of woody vegetation in 1958 (Umwelt 2006b).

The primary mode of reproduction within Hunter Valley populations is currently unknown. The non-pendulous form of Weeping Myall (see section 2.1) readily suckers (Umwelt 2006a), indicating that at least the non-pendulous form is capable of clonal reproduction via underground stems. Weeping Myall is also capable of reproduction via seed, however, seed has not been recorded in the Hunter Valley populations despite surveys in recent years (Bell 2007), and despite plants flowering.

2.5.2 Flowering, pollination and seed production

Flowering times of Weeping Myall are described by various sources to vary, ranging from mainly spring (Costermans 1994) to summer and autumn (Kodela & Harden 2002). During surveys by Umwelt in April 2006, as well as opportunistic sampling in June and August 2006, flower buds and open flowers were found on several Weeping Myall trees in the Hunter Valley. The flowering habit for the species is most likely best described as irregular and usually not annual (Tame 1992b).

Despite a number of surveys since 2006, the non-planted Weeping Myall within the Hunter Valley have rarely been observed to flower, in contrast to the prolific flowering of planted specimens (Bell 2007). Even when flowering has been observed, flowers have failed to produce fruit (Bell 2007). Bell (2007) undertook a brief investigation of the leaf-litter below Weeping Myall trees at a number of locations in 2006 and failed to find any Weeping Myall pods or seed.

Acacia species have generally been found to be self-incompatible (Bernhardt 1987). Pollinators are likely to be small native bees and wasps (Bernhardt 1987).

2.5.3 Seed dispersal and seed bank dynamics

Given the lack of seed observed within the Hunter Valley populations, the following discussions apply only 'if' seed did occur within the Hunter Valley plants. In common with acacia species generally, Weeping Myall produces a 'heavy' seed which falls to the ground beneath the plant as the pods open. Dispersal of the seed is most likely by ants collecting the seed for the nutritious aril (Whitney 2002). The seeds are taken into the nest and later discarded, being dispersed over a wide area around the nest.

There are no reports regarding the germination requirements of Weeping Myall seeds, however, it is assumed they will germinate following a fire or other disturbance event in common with many other acacia species (NSW NPWS 2002). Acacia seeds are 'hard' and adapted to requiring heat or physical disturbance to promote germination.

Seeds are likely to remain viable over many years in the absence of germination cues, with the species likely to develop a long-lived persistent soil-stored seed bank, as is typical for most acacias (NSW NPWS 2002).

2.5.4 Predation

At numerous locations across the Hunter Valley, Weeping Myall is subject to grazing by processionary caterpillars (*Ochrogaster lunifer* — also known as bag shelter moths), which build large shelters in tree canopies by binding leaves together, and which feed on the living foliage of the tree (Umwelt 2006b). These caterpillars may form several colonies that can completely defoliate a large tree (Wrigley & Fagg 1996).

2.5.5 Disturbance ecology

While there is a general understanding of the basic fire ecology of some of the component species of Hunter Valley Weeping Myall, the disturbance ecology of Hunter Valley Weeping Myall at a community level is not well understood. However, in a general sense, too frequent disturbance, and also potentially infrequent disturbance, may lead to a reduction in species diversity and alter the structure and species composition of Hunter Valley Weeping Myall.

Weeping Myall is capable of resprouting following fire and presumably other forms of disturbance such as slashing and grazing (NSW NPWS 2002), although is unlikely to resprout following ongoing and frequent disturbance.

3. Threats and Management Issues

3.1 Threats

3.1.1 Habitat loss and fragmentation

The main threat to the persistence of Hunter Valley Weeping Myall is habitat loss and fragmentation due to clearing for agriculture, mining and to a lesser extent rural/residential development. As much as 88–97% of Hunter Valley Weeping Myall's original distribution may have been cleared (Section 2.2). The remaining remnants are highly fragmented and occur within a rural/mining landscape. None of the 102 Hunter Valley Weeping Myall remnants are contiguous with other vegetation.

3.1.2 Habitat degradation

The remaining Hunter Valley Weeping Myall remnants are also threatened by habitat degradation, primarily from grazing, weed invasion, road maintenance activities and potentially subsidence due to longwall mining.

Most remnants are subject to grazing by domestic stock which limits natural regeneration and seedling recruitment. Young plants are readily grazed by cattle and the foliage and green pods of Weeping Myall are used as stock fodder (Orchard & Wilson 2001).A number of remnants are used as cattle camps which results in soil compaction, nutrient enrichment, tree rubbing and tree pushing. A good example of this occurs at Anvil Hill, which appears to have some of the oldest known Hunter Valley Weeping Myall trees present. Several trees in this stand have been pushed over by cattle, the understorey is very sparse, natural regeneration is not occurring, and the trees are senescing (Umwelt 2006a).

Weed invasion also has a significant effect on Hunter Valley Weeping Myall, particularly in the understorey. The best known example of Hunter Valley Weeping Myall, at Jerrys Plains Cemetery, is under considerable threat from Bridal Creeper (*Asparagus asparagoides*), Mother of Millions (*Bryophyllum delagoense*) and Galenia (*Galenia pubescens*), which are invading the understorey of the community.

Weeping Myall is susceptible to extensive grazing by processionary caterpillar (Umwelt 2006a). This caterpillar is evident on many Weeping Myall in the Hunter and has completely defoliated some trees. It is unknown whether the caterpillar poses a significant threat to the survival of small stands of Weeping Myall, or is natural and the threat posed minimal or cyclical.

The relatively large remnant of Hunter Valley Weeping Myall Woodland present at Wambo Coal Mine, Warkworth, is threatened by proposed longwall mining. This could cause subsidence in the remnant at this location, and may lead to flooding and potentially to drowning of the trees (Umwelt 2006a). Alteration of habitat following subsidence due to longwall mining was listed as a key threatening process on Schedule 3 of the TSC Act.

Some roadside remnants/populations are threatened by possible damage by vehicles, mowing and roadside maintenance activities such as herbicide spraying for weed control and grading for drainage.

Umwelt (2006a) provides further details on site-specific threats.

3.1.3 Long-term consequences of small population size

Over the longer term, Weeping Myall is potentially threatened by the genetic, demographic and environmental stochasticity associated with such a restricted and fragmented distribution and small total population size. Indeed, one hypothesis for the apparent absence of seed set (Section 2.5) is that Weeping Myall is self-incompatible and seed set is rare because the entire Hunter population is made up of one or few genotypes.

3.2 Previous/Existing Recovery Actions

3.2.1 Recovery team

A Hunter Valley Threatened Flora Recovery Team was established in May 2006 to guide OEH in the preparation and implementation of recovery plans for this and other threatened flora in the Hunter Valley. The recovery team includes representatives from OEH, Cessnock City Council, Energy Australia, Forests NSW, Hunter-Central Rivers Catchment Management Authority, Hunter Water, Department of Primary Industries, Roads and Traffic Authority, Muswellbrook Shire Council, Port Stephens Council, Rural Fire Service and Singleton Council. The team also includes representatives from environmental consulting, research, industry and the local community.

3.2.2 Status report

Shortly after the establishment of the recovery team, Umwelt Environmental Consultants were contracted by OEH to collate and document information on the taxonomy, distribution, habitat and ecology of Hunter Valley Weeping Myall (Umwelt 2006a). This report provided information that greatly assisted in the drafting of this recovery plan.

3.3 In-situ protection and habitat management

3.3.1 Jerrys Plains Cemetery

Vegetation and weed mapping of the Jerrys Plains Cemetery site was undertaken in 2006 (Umwelt 2006b). A collaborative project between OEH and Hunter-Central Rivers Catchment Management Authority (now the Hunter Local Land Services - HLSS) implemented weed control works at the site in 2007, 2008 and 2009. OEH funded the continuation of these weed control works in 2010 and Singleton Council is funding 2012 weed control works. The ongoing weed control has significantly reduced the extent of weed infestation (pers.com. Trish Barker, Trees In Newcastle, June 2012). Given the significance of this site (Section 2.4.1) and the high likelihood of reinfestation from surrounding properties, weed control works will need to be ongoing.

Wambo Coal Mine, near Warkworth, fenced a stand of Hunter Valley Weeping Myall in 2006 to prevent cattle grazing (Umwelt 2006a; Bell 2007).

3.4 Community education, awareness and involvement

In 2006, OEH hosted a guided walk though the Hunter Valley Weeping Myall at Jerrys Plains Cemetery.

3.5 Survey and monitoring

Targeted surveys for Hunter Valley Weeping Myall were undertaken in 2006 (Umwelt 2006a) and 2007 (Bell 2007).

Permanent vegetation monitoring quadrats have been established at Jerrys Plains Cemetery (Umwelt 2006b) and within an area at Wambo that was fenced off from grazing in 2006 (Umwelt 2006a; Bell 2007).

3.5.1 Preliminary taxonomic investigation

Bell (2007) undertook preliminary morphological investigation of Weeping Myall in the Hunter Valley. Morphological investigation was complicated by the lack of fruit and seed in the Hunter Valley populations. Continued monitoring of fruiting is required.

4. Proposed Recovery Objectives, Actions and Performance Criteria for 2010–2020

The overall objective of this recovery plan is to abate identified threats and maintain and improve the current extent, condition and ecological function of Hunter Valley Weeping Myall to ensure its long-term persistence in the wild. Specific recovery objectives include the following.

Specific Objective 1: Identify and minimise the threats operating at sites where Hunter Valley Weeping Myall occurs and ensure appropriate ecological restoration where necessary and feasible

Threats operating at sites supporting Hunter Valley Weeping Myall include weed invasion, grazing and clearing. Actions under this objective aim to manage these threats through the implementation of appropriate in-situ threat abatement measures and to gain greater insight into threats.

Performance Criterion 1: No decrease in the area and quality of Hunter Valley Weeping Myall within public lands over the ten years of the plan, and at least one landholder provided with site-specific and targeted advice regarding conservation of Hunter Valley Weeping Myall each year of the plan.

Action 1.1 OEH, Singleton Council and HLSS (Hunter Local Land Services) will facilitate the continued implementation of weed control and on-ground restoration works at the Jerrys Plains Cemetery site.

The weed control program that commenced in 2007 (Section 3.3) requires ongoing maintenance.

Currently, all on-ground restoration work at this site must be undertaken by, or under the direct supervision of, someone with training and experience in bush regeneration techniques and with experience in undertaking weed control in threatened flora habitat.

The long-term vision for this site is to have the local community involved in ongoing weed control (see Action 2.2).

Action 1.2 OEH and HLSS will liaise with selected landholders/managers of land supporting Hunter Valley Weeping Myall to facilitate the implementation of appropriate threat abatement works.

Threat abatement actions are likely to include fencing to exclude grazing, slashing, or mowing and also weed control.

Action 1.3 OEH to monitor the occurrence of processionary caterpillar at the Jerrys Plains cemetery site, and at least three other known locations, to gain greater insight into whether the caterpillar poses a significant threat to the survival of Weeping Myall.

Specific Objective 2: Raise awareness of Hunter Valley Weeping Myall and facilitate community involvement in the recovery program

Increased community awareness and involvement is vital for the effective implementation of this recovery plan. In particular, community involvement with weed control at Jerrys Plains Cemetery is preferred given the need for indefinite ongoing management.

Performance Criterion 2: At least one community activity held each year. In particular, establishing a volunteer weeding group is a high priority given that weed control work at Jerrys Plains Cemetery needs to be ongoing.

Action 2.1 OEH will distribute general information on the progress of the recovery program to raise awareness of the program and encourage community involvement in its implementation.

Action 2.2 OEH will facilitate community involvement in weed control works at Jerrys Plains Cemetery.

At least one community weeding day will be held each year of the plan. Community members will be trained in appropriate weed control techniques, with a view to the community being actively involved in management of the site over the long term.

Action 2.3 OEH will seek opportunities for engagement with the Aboriginal community through the Aboriginal Cultural and Environmental Network and the Wanaruah LALC with respect to the Hunter Valley Weeping Myall recovery program.

Specific Objective 3: Improve management and long-term security of sites supporting Hunter Valley Weeping Myall

Hunter Valley Weeping Myall is not known to occur within any conservation reserves. This objective aims to improve the management and long-term protection of Hunter Valley Weeping Myall, particularly for the Jerrys Plains Cemetery site.

Umwelt (2006a) identifies priority sites for conservation and these priority sites should be the first to be considered.

Performance Criterion 3: Singleton Council are advised regarding opportunities and advantages of entering into a conservation agreement for the Jerrys Plains site by year one of the plan, and at least one landholder is advised every year of the plan thereafter.

Action 3.1 HLSS and OEH will advise selected landholders, including Singleton Council, of the opportunities and advantages of entering into conservation agreements and covenants.

Action 3.2 OEH will develop a Hunter Valley Weeping Myall field identification and management guide for landholders.

The guide will include information on the identification and management of Hunter Valley Weeping Myall and will direct landholders to additional resources and contacts, particularly in regard to opportunities for funding. The guide will be distributed to all landholders whose property is known to support Hunter Valley Weeping Myall and will be distributed to other landholders via field days and other community activities.

Action 3.3 To align the State and Commonwealth threatened community determinations and conservation advice, nominations will be submitted to the NSW Scientific Committee and the Commonwealth Threatened Species Scientific Committee proposing to remove and re-list the communities with amended floristic and distributional delineations.'

Specific Objective 4: Distribute information that assists in conserving and managing Hunter Valley Weeping Myall

The prompt and effective distribution of information on Hunter Valley Weeping Myall is an important component of ensuring that its conservation requirements are appropriately considered in decisions regarding land management, land-use planning, development control and hazard reduction activities.

Performance Criterion 4: Information available to other public authorities and the general public — particularly via the OEH Atlas of NSW Wildlife and threatened species website — is maintained and up-to-date over the ten years of the plan.

Action 4.1 OEH, HLSS, Singleton Council and Muswellbrook Shire Council will facilitate the survey and confirmation of potential occurrences, and lodging of Wildlife Atlas records for any new sightings of Weeping Myall in the Hunter Valley not already recorded in the Atlas of NSW Wildlife.

It is feasible that additional populations of Weeping Myall will be discovered over time, however, most are likely to be present on private property and only located opportunistically.

Responsible parties will also facilitate survey and confirmation of potential occurrences.

Action 4.2 OEH will coordinate the prompt distribution of site records for Weeping Myall through the Atlas of NSW Wildlife.

Action 4.3 OEH will update information sources for Hunter Valley Weeping Myall (Priorities Action Statement and Information Profiles) to incorporate information acquired during the implementation of this recovery plan.

Specific Objective 5: Gain greater insight into the taxonomy of Weeping Myall within the Hunter catchment

Taxonomic clarification of Weeping Myall in the Hunter catchment is currently hampered by a lack of fruiting material. Anecdotal observations suggest the taxon may not set fruit every year (or indeed at all) and consequently it may take a few years to obtain sufficient material.

Taxonomic clarification is not currently considered a high priority for recovery planning purposes. As stated previously under Section 2.1.1, at present, given available information, both the pendulous and non-pendulous forms within the Hunter Valley are considered Weeping Myall.

In the absence of fruiting material, a genetic study would be required to clarify taxonomy. Given the cost of such a genetic study, this plan advocates encouraging research institutions to conduct the research in partnership, rather than seek funding for the research. The outcomes of this work will be used to determine subsequent actions.

Performance Criterion 5: Opportunistic survey of selected Weeping Myall populations for fruit and seed set over the ten years of the plan.

Action 5.1 OEH will facilitate monitoring of fruit in selected populations of Weeping Myall over the life of the plan.

Action 5.2 OEH will facilitate seed bank sampling to investigate the possibility that the majority of Weeping Myall stands are sterile hybrids.

Replicated sampling should be undertaken in several stands in an effort to determine whether or not plants have flowered and fruited in previous seasons.

Action 5.3 OEH will promote and facilitate research into the taxonomy of Weeping Myall.

5. Implementation

Table 3 outlines the implementation of recovery actions specified in this recovery plan relevant to government agencies and/or parties for the period of ten years from publication.

6. Social and Economic Consequences

6.1 Social consequences

Negative social impacts are not envisaged as the implementation of this recovery plan is not expected to affect public land usage to any great extent, and modification of private land management will occur at the land manager's discretion. Continued liaison with the local community, affected landholders and government agencies will address and minimise any unforeseen negative social impacts arising from the conservation of Hunter Valley Weeping Myall.

It is expected that recovery plan implementation, including a community awareness and involvement program, will have positive social impacts on the local communities, in particular, Jerrys Plains.

6.2 Economic consequences

The economic consequences of this recovery plan are those costs that are associated with its implementation. These include on-ground habitat management, vegetation survey and mapping, community education and awareness, and ongoing recovery program coordination.

These costs can be offset and minimised by seeking funds from external sources and adopting a cooperative approach to management involving the relevant land managers and the community.

It is anticipated that the overall benefits to society of implementation of the recovery plan will outweigh any specific costs.

6.3 Role and Interests of Indigenous People

The Wanaruah Local Aboriginal Land Council (LALC) represents the indigenous people in the areas where the Hunter Valley Weeping Myall occurs. It is the intention of the Recovery Team to consider the roles and interests of the Aboriginal community in the implementation of the actions identified in this plan. An opportunity for engaging with the Aboriginal community will be sought through the Hunter-Central Rivers CMA Aboriginal Cultural and Environmental Network (ACEN) and through the Wanaruah LALC.

7. Biodiversity Benefits

The conservation of Hunter Valley Weeping Myall will benefit a number of regionally significant flora species that share its habitat, including: Yarran (A. *omalophylla-melvillei*), Mealy Saltbush (*Rhagodia parabolica*), *Ptilotus semilanatus*, and Caustic Vine (*Sarcostemma viminale* subsp. *australe*), all regarded as regionally significant in the Hunter catchment (Peake 2006).

Conserving habitat within the highly cleared and fragmented Hunter Valley floor will also contribute to the conservation of fauna in general, including threatened woodland birds such as the Speckled Warbler, Painted Honeyeater, Diamond Firetail, Hooded Robin, Brown Treecreeper and Grey-crowned Babbler.

Hunter Valley Weeping Myall occurs in the 'mid valley' area identified as of interest in the Great Eastern Ranges Initiative http://www.greateasternranges.org.au/.

8. Preparation Details

Funding for the preparation of this plan was provided by the Australian Government.

This recovery plan has been prepared by Tricia Hogbin of Ecosystems and Threatened Species Team in the OEH Hunter Central Coast Region, North Branch, in consultation with the Hunter Valley Threatened Flora Recovery Team.

The development of this recovery plan was greatly assisted by Travis Peake and Liza Hill of Umwelt Environmental Consultants who, on behalf of OEH, documented information on the taxonomy, distribution, habitat and ecology of Weeping Myall and related ecological communities in the Hunter catchment (Umwelt 2006a). Preliminary ecological and taxonomic research undertaken by Stephen Bell (Bell 2006, 2007) also contributed to the development of this recovery plan.

9. Review Date

The Australian Government will review this plan in five years.

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11. Acronyms Used in this Document

CEEC	critically endangered ecological community
EEC	endangered ecological community
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
HLSS	Hunter Local Land Services
LGA	local government area
NSW	New South Wales
OEH	Office of Environment and Heritage
TSC Act	NSW Threatened Species Conservation Act 1995

Table 3. Estimated costs of implementing the actions identified in the recovery plan

Action no	Action Title	Priority[1]	Cost Estimate ($'s/yr)[2]										Total Cost ($)	Responsible Party[3]	Fund source[4]
			Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10			
1.1	Weed control Jerrys Plains	1	10 000	10 000	10 000	3 000	3 000	1 900	1 900	1 900	1 900	1 900	45 500	OEH, HCRCMA, SC	Secured yr 1, Unsecured yrs 2–10
1.2	Advise re threat abatement	2	#	#	#	#	#	#	#	#	#	#	-	OEH, HCRCMA	In kind
1.3	Monitor and assess the threat of the processionary caterpillar	2	#	#	#	#	#	#	#	#	#	#	-	OEH, HCRCMA	In kind
2.1	Distribute general information	2	800	800	800	800	800	800	800	800	800	800	8 000	OEH	In kind
2.2	Facilitate community involvement weeding	1	1 900	1 900	1 900	1 900	1 900	1 900	1 900	1 900	1 900	1 900	19 000	OEH	Unsecured
3.1	Advise re agreements and covenants	2	#	#	#	#	#	#	#	#	#	#	-	OEH, HCRCMA	In kind
3.2	Identification and management guide	2	3 800	-	-	-	-	-	-	-	-	-	3 800	OEH	In kind
4.1	Lodge Wildlife Atlas records	2	#	#	#	#	#	#	#	#	#	#	-	OEH, SC, MSC, HCRCMA	In kind
4.2	Distribute site records via wildlife Atlas	2	#	#	#	#	#	#	#	#	#	#	-	OEH	In kind
4.3	Maintain information sources	2	#	#	#	#	#	#	#	#	#	#	-	OEH	In kind
5.1	Monitoring for fruit	3	*	*	*	*	*	*	*	*	*	*	-	OEH	In kind
5.2	Seed bank sampling	3	*	*	*	*	*	*	*	*	*	*	-	OEH	Unsecured
5.3	Promote and facilitate taxonomic research	3	*	*	*	*	*	*	*	*	*	*	-	OEH	In kind
			0	0	0	0	0	0	0	0	0	0	0		External
	Annual and total cost		1 900	11 900	11 900	4 900	4 900	3 800	3 800	3 800	3 800	3 800	**54 500**		**Unsecured**
			14 600	800	800	800	800	800	800	800	800	800	**21 800**		**In Kind**
			16 500	**12 700**	**12 700**	**5 700**	**5 700**	**4 600**	**4 600**	**4 600**	**4 600**	**4 600**	**76 300**		**TOTAL**

[1] Priority ratings are: 1 Action critical to meeting plan objectives, 2 Action contributing to meeting plan objectives, 3 Desirable but not essential action.

[2] # No direct cost (either cost of action is negligible or action is an existing responsibility of the responsible party), * Amount to be determined by the responsible party

[3] OEH: Office of Environment and Heritage; SC: Singleton Council; HCRCMA: Hunter-Central Rivers Catchment Management Authority; MSC: Muswellbrook Shire Council.

[4] In kind funds represent the salary component of permanent staff and recurrent resources. External funds are those that have already been provided by external sources. Unsecured funds will be sought from external sources.

Appendix 1 - Hunter Valley Weeping Myall population details

Pop No	Local Govt	District	No of Sites	No of Adults	No of Juv's	Area Ha	Estimate Type	Growth form	Tenure	Zoning
	Confirmed Natural Populations		**43**							
46	Upper Hunter	Wybong Heights	1	42	58	0.05	Exact	ND	Private Freehold	Rural General
50	Muswellbrook	Muswellbrook	1	1		0.003	Exact	ND	Private Freehold	Environment Protection
53	Muswellbrook	Muswellbrook	3	3		2.443	Exact	ND	Private Freehold	Open Space / Residential
40	Muswellbrook	Castle Rock	1	1		0.003	Assumed	Non-pendulous	Development offset area	Environment Protection
4	Muswellbrook	Wybong Creek	9	119		0.081	Estimated	Both forms	Development offset (Private freehold)	Ag Protection / Env Protection
18	Muswellbrook	Wybong Creek	1	20		0.003	Estimated	ND	Private Freehold	Agricultural Protection
44	Muswellbrook	Gungal	2	9		0.006	Estimated	ND	Private Freehold	Agricultural Protection
24	Muswellbrook	Kerrabee	1	180		0.01	Estimated	Non-pendulous	RailCorp	Agricultural Protection
23	Muswellbrook	Sandy Hollow	4	127		0.026	Estimated	Non-pendulous	RailCorp	Agricultural Protection
30	Muswellbrook	Sandy Hollow	1	50		0.01	Estimated	Non-pendulous	Private Freehold	Environment Protection
43	Muswellbrook	Sandy Hollow	1	50		0.01	Estimated	ND	Private Freehold	Agricultural Protection
45	Muswellbrook	Sandy Hollow	1	1		0.003	Assumed	ND	Private Freehold	Agricultural Protection
42	Muswellbrook	Denman	11	508		0.159	Estimated	ND	Private freehold (& Road verge)	Residential
7	Muswellbrook	Denman North	1	8		0.013	Exact	Pendulous	Road verge	Special Purposes
39	Muswellbrook	Denman North	1	1		0.003	Assumed	Non-pendulous	Road verge	Special Purposes
59	Muswellbrook	Denman North	1	1		0.003	Assumed	ND	Road verge	Agricultural Protection
58	Muswellbrook	Denman Knob	5	5		0.015	Assumed	ND	Private Freehold	Environment Protection
5	Muswellbrook	Anvil Hill	4	44		0.016	Estimated	Non-pendulous	Road verge	Agricultural Protection
6	Muswellbrook	Anvil Hill	5	12		0.015	Estimated	Non-pendulous	Private freehold (& Road verge)	Ag Protection / Env Protection
56	Muswellbrook	Anvil Hill	4	4		0.012	Assumed	ND	Private Freehold	Environment Protection
57	Muswellbrook	Anvil Hill	1	1		0.003	Assumed	ND	Development offset area	Environment Protection
11	Muswellbrook	Edderton	1	150		0.04	Exact	Non-pendulous	Road verge	Agricultural Protection
16	Muswellbrook	Saddlers Creek	4	42	375	0.066	Estimated	Non-pendulous	Private freehold & Coal mine lease	Ag Protection / Env Protection
60	Muswellbrook	Saddlers Creek	1	5		0.025	Estimated	ND	Development offset area	Agricultural Protection
61	Muswellbrook	Saddlers Creek	1	1		0.003	Exact	ND	Road verge	Agricultural Protection
62	Muswellbrook	Saddlers Creek	2	40	30	0.25	Estimated	ND	Private Freehold	Agricultural Protection
26	Muswellbrook	Plashett	1	130		1	Estimated	Non-pendulous	Private Freehold	Agricultural Protection
71	Muswellbrook	Esdai	1	1		0.003	Exact	ND	Private Freehold	Agricultural Protection
28	Muswellbrook	Bureen Road West	1	50		0.01	Estimated	Non-pendulous	Road verge	Environment Protection

Pop No	Local Govt	District	No of Sites	No of Adults	No of Juv's	Area Ha	Estimate Type	Growth form	Tenure	Zoning
69	Singleton	Bureen Road East	1	2		0.003	Estimated	ND	Private Freehold	Rural General
17	Singleton	Bureen Road East	3	190		0.23	Estimated	Non-pendulous	Private Freehold	Rural General
29	Singleton	Bureen Road East	1	20		0.003	Estimated	Non-pendulous	Private Freehold	Rural General
10	Singleton	Jerry's Plains	3	401		3.343	Estimated	Both forms	Community Land & Road verge	Rural General / Rural Residential
25	Singleton	Jerry's Plains	1	6		0.005	Exact	Pendulous	Road verge	Rural General
37	Singleton	Jerry's Plains	1	1		0.003	Assumed	Non-pendulous	Private Freehold	Rural General
52	Singleton	Liddell	1	1		0.003	Assumed	ND	Private Freehold	Rural General
51	Singleton	Falbrook	1	1		0.003	Assumed	ND	Private Freehold	Rural General
36	Singleton	Maison Dieu	1	1		0.003	Assumed	Non-pendulous	Private Freehold	Residential
34	Singleton	Gouldsville	2	16		0.006	Estimated	Non-pendulous	Private Freehold	Rural General
8	Singleton	Wambo	1	320		2.5	Estimated	Non-pendulous	Road verge	Rural General
9	Singleton	Wambo	10	58		0.037	Estimated	Non-pendulous	Coal mine lease (& Road verge)	Rural General
31	Singleton	Bulga - Broke	2	326	125	0.103	Estimated	ND	Coal mine lease & Road verge	Rural General
73	Singleton	Bulga - Broke	3	387	1,725	4.2	Estimated	ND	Coal mine lease	Rural General
		Sub-total	**102**	**3,336**	**2,313**	**14.73**				
Unconfirmed Natural Populations			**9**							
21	Upper Hunter	Bow River	1	1		0.003	Estimated	ND	Road verge	Rural General
49	Upper Hunter	Sandy Creek	1	9		0.003	Assumed	ND	Private Freehold	Rural Residential
48	Upper Hunter	Glenbawn	4	4		0.012	Assumed	ND	Private Freehold	Agricultural Protection
47	Upper Hunter	Glenbawn	1	1		0.003	Assumed	ND	Private Freehold	Proposed Roads
54	Muswellbrook	Thomas Mitchell Dv	1	300		0.1	Estimated	ND	Development offset area	Environment Protection
70	Muswellbrook	Esdai	1	1		0.003	Assumed	ND	Private Freehold	Agricultural Protection
69	Singleton	Bureen Road East	1	1		0.003	Assumed	ND	Private Freehold	Rural General
72	Singleton	Gouldsville	1	35		0.003	Estimated	ND	Coal mine lease	Rural General
74	Singleton	Bulga - Broke	1	5		0.1	Assumed	ND	Coal mine lease	Rural General
		Sub-total	**12**	**357**	**0**	**0.23**				
Confirmed Planted Populations			**13**							
12	Upper Hunter	Merriwa	1	1		0.003	Assumed	ND	Private Freehold	Rural General
19	Upper Hunter	Merriwa	1	20		0.06	Estimated	ND	Road verge	Rural General
3	Muswellbrook	Castle Rock	1	25		1	Estimated	ND	Private Freehold	Agricultural Protection
20	Muswellbrook	Wybong Creek	1	1		0.003	Exact	ND	Private Freehold	Agricultural Protection
38	Muswellbrook	Edderton	1	2		0.003	Exact	Pendulous	Private Freehold	Agricultural Protection
2	Singleton	Cumnock	1	1		0.01	Exact	ND	Coal mine lease	Rural General
67	Singleton	Ravensworth	4	3		0.009	Assumed	ND	Coal mine lease (& Road verge)	Rural General

Pop No	Local Govt	District	No of Sites	No of Adults	No of Juv's	Area Ha	Estimate Type	Growth form	Tenure	Zoning
81	Singleton	Ravensworth	1	1		0.003	Assumed	ND	Private Freehold	Rural General
65	Singleton	Ravensworth West	1	1		0.003	Assumed	ND	Coal mine lease	Rural General
1	Singleton	Belford	1	5		0.01	Exact	ND	Private Freehold	Rural General
32	Cessnock	Cessnock	1	1		0.003	Assumed	Pendulous	Private Freehold	Special Purposes
33	Cessnock	Cessnock	1	1		0.003	Assumed	Pendulous	Private Freehold	Rural Residential
41	Cessnock	Lochinvar	1	1		0.003	Assumed	Pendulous	Private Freehold	Residential
		Sub-total	**16**	**63**		**1.11**				
Unconfirmed Planted Populations			**9**							
14	Upper Hunter	Gundy	1	1		0.003	Assumed	ND	Private Freehold	Agricultural Protection
15	Upper Hunter	Gundy	1	1		0.003	Assumed	ND	Private Freehold	Agricultural Protection
68	Singleton	Ravensworth	1	1		0.003	Assumed	ND	Private Freehold	Rural General
55	Muswellbrook	Edderton	1	8		0.25	Assumed	ND	Coal mine lease	Agricultural Protection
35	Muswellbrook	Thomas Mitchell Dv	1	1		0.003	Assumed	Non-pendulous	Road verge	Industrial
27	Muswellbrook	Plashett	1	1		0.003	Estimated	ND	Private Freehold	Agricultural Protection
63	Singleton	Ravensworth West	1	1		0.003	Assumed	ND	Coal mine lease	Rural General
64	Singleton	Ravensworth West	1	1		0.003	Assumed	ND	Coal mine lease	Rural General
66	Singleton	Ravensworth West	1	1		0.003	Assumed	ND	Coal mine lease	Rural General
		Sub-total	**9**	**16**		**0.27**				
Unconfirmed Location Populations			**3**							
22	Upper Hunter	Cassilis	1	1				ND	Private Freehold	Rural General
77	Muswellbrook	Wybong Creek	1	1				ND	Private Freehold	Agricultural Protection
78	Singleton	Mt Owen	1	1				ND	Private Freehold	Rural General
		Sub-total	**3**	**3**						
Likely Mined Populations			**4**							
75	Muswellbrook	Anvil Hill	2	2				ND	Coal mine lease	Environment Protection
76	Muswellbrook	Anvil Hill	1	1				ND	Coal mine lease	Environment Protection
79	Muswellbrook	Anvil Hill	1	1				ND	Coal mine lease	Environment Protection
80	Muswellbrook	Anvil Hill	1	1				ND	Coal mine lease	Agricultural Protection
		Sub-total	**5**	**5**						
Misidentification Population			**1**							
13	Mid Western	Wollar	1						Private Freehold	Agricultural Protection
All	**Total**	**80 Populations**	**147**	**3,780**	**2,313**				(Does not include Misidentified population at Mt Misery)	