

*Big Scrub Rainforest Remnant Care Project.
1997-1998.*

Willowbank

Rainforest Restoration Management Plan.



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for the

Big Scrub Rainforest Landcare Group.

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Executive Summary.

Willowbank is a 3 hectare remnant of the once vast Big Scrub rainforest which covered over 75, 000 hectares. Less than 1% of this remains as fragmented remnants. They are important regardless of their size as refuge for the original flora and fauna, for the role they play in providing corridors and/or stepping stones amongst a fragmented ecosystem and as a seed source for regrowth areas. These remnants contain important ecological information regarding the original species mixes throughout the region and are invaluable for an array of scientific research

Willowbank contains over one hundred and forty plant species of which six are listed as Rare or Threatened Australian Plants R.O.T.A.P. and of these two are listed as Schedule 2 Threatened under the N.S.W. Threatened Species Conservation Act 1995. Although no formal fauna surveys have been undertaken the remnant undoubtedly supports a high diversity of fauna (common and rare).

Willowbank is significantly impacted by weed species typical to northern N.S.W. rainforest remnants surrounded by agricultural lands. The remnant's ability to resist weed invasion is limited by edge effects (particularly excess light and wind & temperature fluctuations), continued weed seed dispersal and impacts associated with previous disturbances. The limited size, narrow shape, level of weed infestation and isolation from contiguous forest limit the resilience of Willowbank to future disturbances from floods, natural attrition and edge effects. Weed species are favoured in areas of higher light levels and are displacing natives, particularly around the edge, in gaps and along the riparian zone.

Of the thirty weed species identified, ten may pose long term problems to the regeneration capacity, viability and ecosystem integrity of the remnant by outcompeting, deflecting and dominating the vegetation thus degrading the species diversity, abundance and ecofunctions present.

For the effective long-term management of fragmented, weed impacted native vegetation communities a strategic, holistic, yet flexible range of management options needs to be adopted. To reduce the negative impacts that affect the long-term viability of Willowbank a systematic regeneration program utilising a range of management and restoration techniques will need to be employed. This plan provides a range of recommendations and a work schedule that will act as a guide to help bush regenerators and remnant managers restore this remnant.

1. INTRODUCTION.

1.1. Purpose and Scope of the Report.

This Management Plan was prepared by Hank and Sue Bower as part of the Big Scrub Rainforest Remnant Care Project which is funded by National Heritage Trust funding. The project was developed to address the impacts of weed invasion, livestock and human impacts that are currently seriously effecting the long term viability of the fragmented isolated Big Scrub remnants. Initial on ground restoration works is to be undertaken by a Greencorps team under the co-supervision of an EnviTE supervisor and a contracted private bush regenerator.

A long term commitment by the Big Scrub Rainforest Landcare Group (B.S.R.L.G.), relevant government agencies, the community and private landholders is required to sustain and increase the long term viability of these remnants. For the effective long-term management of fragmented, weed impacted native vegetation communities a strategic, holistic, yet flexible range of management options need to be adopted including weed control and remnant extension.

This management plan lists the regeneration aims, vegetation health and impacts, restoration recommendations, species lists and site map/s for use in future regeneration works. It provides a range of relevant restoration techniques for each stratum and/or impact to help rectify the problems that are affecting the regeneration capacity of Willowbank, (see Appendix 4 for Work Schedule).

2. BACKGROUND.

2.1. Regional Context of the Big Scrub.

Willowbank is an isolated remnant of the once vast Big Scrub, which was approximately 75,000 hectares of subtropical rainforest associated with the Mount Warning Volcanics, (refer to Fig 1 Map of Big Scrub remnants). The Big Scrub is approximately located between east Lismore, Alstonville, St. Helena and Dunoon (Holmes 1987, Floyd 1990, Mezzatesta 1992, Lott & Duggin 1993). By the early 1900's much of the Big Scrub had been reduced to a series of isolated remnants that comprise less than 1% (or 300 ha.) of the original vegetation (Frith 1976, Floyd 1990, Lott & Duggin 1993, Adam 1994)

The Big Scrub lies within the McPherson-Macleay biogeographical overlap zone (CSIRO 1995). This zone is a convergence area for northern and southern biota's resulting in many species reaching their southern or northern limits in the region. The region is palaeogeographically significant in that three of Australia's five land biota's mingle; being Tumbunan (subtropical), Bassian (temperate) and Torresian (tropical) (CSIRO 1995). The Big Scrub rainforests largely favour Tumbunan biota but also display Bassian and Torresian elements, particularly since clearing.

The parent material is Tertiary Lismore basalt that derived from the Mount Warning Volcanics and weathered to acidic clay loam's of variable depths with potentially high fertility in the organic layer. Kraznozems mainly occur in areas that have high rainfall (> 1300) and warm temperatures and grow lush, subtropical rainforests in the Big Scrub region (Floyd 1990, Lott & Duggin 1993).

Willowbank occurs on a southerly slope ranging from 90m to 110m above sea level. The remnant is dissected by two drainage lines which drain to the south eastern section of the remnant. The lower drainage line collects runoff from the road resulting in increased water inputs, localised erosion and weed infestations (Wandering Jew *Tradescantia flumenensis*).

2.5. Vegetation Description.

FLORSITICS

Floyd (1990a) recognises four major floristic suballiances within the 'true' Big Scrub. Three of these are within the *Heritiera* (Booyong) alliance; (previously *Argyrodendron*):

- *Heritiera trifoliolata* suballiance No. 1.
- *Cryptocarya obovata-Dendrocnide excelsa-Ficus spp.-Araucaria* suballiance No. 3.
- *Castanospermum australe-Dysoxylum mollissimum* (previously *muelleri*) suballiance No. 5.

The other is within the *Drypetes-Araucaria* alliance;

- *Araucaria* suballiance No 21.

Willowbank is belongs to the White Booyong *Heritiera trifoliolata* alliance which is characteristic of lowland subtropical, complex Notophyll vine forest through the Big Scrub. Floyd (1990b) describes this alliance as the most structurally complex rainforest alliance in N.S.W. It requires protection from salt laden winds, cold or hot drying winds and potentially occurs on some of the best agricultural land. It has been virtually destroyed except for small remnants which were either flood prone, inadequately drained, rather stony or left due to surveying errors.

The White Booyong alliance can be further divided to a suballiance. Willowbank exhibits characteristics to the suballiance No.1 *Heritiera trifoliolata* – White Booyong owing to the dominance of this species in the canopy. Other canopy dominants include Cudgeri - *Flindersia schottiana*, Pepperberry – *Cryptocarya obovata*, Red Ash-*Alpitonia excelsa* and Black Bean – *Castanospermum australe*.

Six plant species listed as being Rare Or Threatened Australian Plants (R.O.T.A.P) have been found at Willowbank and of these two are listed under a Schedule of the N.S.W. Threatened Species Conservation Act 1995 (Schedule 1 = Endangered and Schedule 2 =Vulnerable). These are; Veiny Laceflower *Archidendron muellerianum* (3RCa), Smooth Scrub Turpentine *Rhodamnia maideniana* (2RC-), Red Lilly Pilly *Syzygium hodgkinsoniae* (3VC- Schedule 2), Arrow-head Vine *Tinospora tinosporoides* (3RC-, Schedule 2), Silky Cucumber *Trichosanthes subvelutina* (3RC-) and Quassia *Quassia* sp. A (3RC-).

2.6. Fauna.

Willowbank provides important habitat for a range of sedentary and nomadic fauna. Sedentary species rely on the site all year round whilst nomadic species opportunistically use the site for feeding and breeding when suitable resources are available. Being an isolated rainforest remnant this site is an important stepping stone for nomadic nectivorous and frugivorous fauna that effectively disperse seeds and pollen. The fauna of the site is largely impacted by the surrounding landscape. Much of the fauna that use the site are open habitat generalist species. These species use the site for refuge and as breeding habitat. Specialist species dependent on rainforests or contiguous forest are disadvantaged by the remnants isolation from surrounding vegetation, its small size and competition by aggressive generalist species.

No formal fauna surveys have been undertaken at Willowbank. Fauna data from similarly sized remnants (and regrowth areas) throughout the Big Scrub indicate that such remnants provide important habitat for a diversity of frog, reptile, bird and mammal species (particularly mobile species such as birds and bats).

Fauna species listed under the T.S.C. Act, 1995, that are likely to occasionally use Willowbank include Bush Hen, Rose-crowned Fruit-dove, Wompoo Fruit-dove, Superb Fruit-dove, Barred Cuckoo-shrike, White-eared Monarch, Black Flying Fox, Eastern Tube-nosed Bat and up to six micro-chiropteran (insectivorous) bat species. The habitat requirements of nomadic species require consideration prior to undertaking any restoration works (see Habitat Requirements below). Without seasonal targeted fauna surveys many of these species (and other common fauna not listed under the T.S.C. Act, 1995) may remain undetected, particularly cryptic and/or nocturnal species such as the micro-chiropteran bats, reptiles and frogs. Fauna surveys should be undertaken by someone competent in systematic and opportunistic survey techniques for all fauna groups who holds a current Scientific Investigation License.

2.6.1. Habitat Types.

Willowbank displays several habitat types, which provide a variety of environments/niches for fauna typical to certain habitats.

* The rainforest habitat is important for rainforest specialist species whilst also providing important foraging and breeding habitat for many open habitat species.

* The adjacent open agricultural habitat favours generalist species that are common throughout disturbed environments in eastern Australia. These include species such as the Magpie, Pied Butcherbird, Noisy Miner, Torresian Crow, Eastern Brown Snake, Lace Monitor and feral animals such as the Rabbit, Black Rat, Fox, Cat, Cane Toad and ranging domestic animals such as Cats and Dogs.

* Secondary regrowth forests dominated by woody weeds in the surrounding landscape are similar to regrowth rainforest in canopy structure but lack structural and species diversity in the lower stratum. Such forests are useful as corridors/stepping stones and habitat for species that favour closed forests. These regrowth areas are providing an important seasonal food source for frugivorous birds and have been attributed to an increase in the numbers of several species. Incremental habitat removal/replacement and strategic natural regeneration from the understorey upward should maintain the existing habitat values in these regrowth patches.

affected by edge effects is for this report termed as core forest. Remnants that display high edge to area ratios may be too small to have an area of core forest as edge effects may prevail throughout (Lott & Duggin 1993).

Altered climatic regimes can dramatically alter micro-climate, hydrology, vegetation succession and available habitat/food resources. This can disadvantage certain species dependent upon specific conditions. An increase in the incidence of fire, agricultural spraying, weeds, feral animals, livestock and people causes either direct loss or disturbance to habitat or displacement via disturbance, competition and/or predation (Sivertsen 1995, Friend 1987, Sisk & Margules 1993).

Landscape fragmentation results in alteration of the previous environment. Changes can include;

- Microclimate change.
- Increase in wind penetration and turbulence.
- Increased solar radiation, temperature and light.
- Alter the hydrology and water quality.
- Alter soil stability and nutrient balance.
- Change in vegetation structure/composition and faunal communities.
- Food and habitat resources are removed or altered.
- Altered predator/prey relationships.

(Start 1991, Scougall et al 1993).

2.7. Previous Works.

Previous restoration works have not been carried out at Willowbank. The lower eastern portion of the remnant is fenced off from cattle whilst the upper eastern section remains unfenced. It appears that the horses grazing in this adjoining paddock are not impacting the remnant although this may change if edge weeds, which act as a barrier, are removed. The lower eastern boundary fence is deteriorating in areas, being overgrown by Lantana and requires the repair.

3. AIMS and OBJECTIVES.

This management plan **Aims** to outline the impacts effecting the regeneration and long term viability of Willowbank so that Recommendations can be developed to;

- 1) Restore, protect, maintain Willowbank as an example of a Big Scrub remnant; and
- 2) Restore, maintain and increase the natural resilience of Willowbank so the flora and fauna that utilise this site can resist further impacts.

The **Objectives** of this study are to;

- 1) Summarise any previous works
- 2) Identify and assess impacts and develop appropriate recommendations for the effective long-term restoration and regeneration of the native vegetation at Morton's Scrub.
- 3) Map the remnant and location of major weed infestations, gaps and any other management problems that are effecting the viability of the remnant (see Appendix 1).
- 4) Identify flora species, particularly species listed as Schedule 1 or 2 on the N.S.W. Threatened Species Conservation Act. 1995. or as Rare or Threatened Australian Plants (R.O.T.A.P.) and exotic weeds.

regression or 'stagnation' (Lovejoy 1985) is exacerbated by harsh edge effects, fragmentation of contiguous forest (limiting movement of genetic material), agricultural activities, browsing from livestock, deflection by exotic weeds and domination by native woody vines. Poor faunal distribution of mature phase species throughout the isolated Big Scrub remnants is resulting in a lower recruitment of mature phase species than in contiguous forests (Dunphy 1992, Hopkins 1990 and Adam 1994). However the use of Big Scrub remnants and regrowth areas as "stepping stones" for frugivorous avifauna and fruit-bats and the role they play in seed and pollen dispersal is fundamental to the long-term viability to any remnant (Date et. al. 1991).

To ensure the long-term viability of floral and faunal communities in the small, fragmented Big Scrub remnants, extension plantings may be required to increase the size, buffer harsh edge effects and to create links between neighbouring remnants and/or areas of regrowth.

Use of locally sourced, seed grown, native tree's from variable parentage is advised to maintain genetic diversity (be aware of inbreeding and outbreeding depression). Planting composition and design should follow the Kooyman model of accelerated succession (Kooyman 1991 & 1996) which utilises a high species diversity of pioneer, secondary and mature phase species, with a preference towards late secondary and mature phase species.

A team supervised by a qualified rainforest regenerator with skills in plant identification, vegetation management and weed control should undertake all regeneration works. Team members should be adequately trained or be undergoing training.

5. SITE ASSESSMENT of VEGETATION HEALTH/IMPACTS and RECOMMENDATIONS.

5.1. The Main Impacts at Willowbank.

The remnants limited size, elongated shape, gaps, level of weed infestation and isolation from contiguous forest limit its resilience to future disturbances from natural attrition and edge effects. Additionally the remnant has a high edge to area ratio, which reduces the forest's ability to recover from further disturbance. Future disturbances such as tree falls (which is highly likely due to the senescence/age of mature canopy trees) will create gaps in the canopy allowing light to the lower stratum, thus releasing suppressed weeds in these stratum.

Problems associated with disturbance are exacerbated by arrested succession in the lower stratum (due to weed inhibition), existing canopy gaps, high edge to area ratio and a simplified structure in areas of previous disturbance. To minimise edge effects it is essential to promote the establishment of a dense edge and canopy and structural complexity. This can be achieved by promoting canopy, midstorey and edge recruits through natural regeneration or by buffering edge plantings.

A serious weed is considered as a plant that can cause a major modification to the species richness, abundance or ecosystems function (Fox & Adamson 1990). Nine serious weed species indicated in Dunphy (1991) are evident in Willowbank. These are displacing natives, particularly around the edge, gaps and in the understorey. Up to thirty exotic weed species have been identified at Willowbank. Ten of these may pose long term problems to the regeneration capacity, viability and ecosystem integrity of the remnant by outcompeting, deflecting and dominating the vegetation thus degrading the species diversity, abundance and ecofunctions present.

Weeds are listed regarding the stratum in which they grow, e.g. canopy, midstorey, understorey and edge. Weed dispersal mechanisms are also listed (see Table 1).

Table 1. Weeds Of Morton's Scrub, Eureka.

1.1. Trees.

Common Name	Species Name	Family	Growth Stratum	Dispersal Mechanism
Camphor Laurel ~ #	* <i>Cinnamomum camphora</i>	Lauraceae	2 3 4	(a)
Large-leaved Privet ~ #	* <i>Ligustrum lucidum</i>	Oleaceae	1 2 3 4	(a,b,d)
Small-leaved Privet ~ #	* <i>Ligustrum sinense</i>	Oleaceae	1 2 3 4	(a,b,d)

1.2. Shrubs.

Common Name	Species Name	Family	Growth Stratum	Dispersal Mechanism
Groundsel Bush	<i>Baccharis halmifolia</i>	Asteraceae	4	(c)
Coffee	<i>Coffea arabica</i>	Rubiaceae	3	(a)
Lantana ~ #	* <i>Lantana camara</i>	Verbenaceae	3 4	(a,d)
Ochna ~ #	* <i>Ochna serrulata</i>	Ochnaceae	3 4	(a)
Smooth Senna #	* <i>Senna X floribunda</i>	Caesalpinoideae	3 4	(a,i,j)
Winter Senna #	* <i>Senna pendula</i> var. <i>glabrata</i>	Caesalpinoideae	3 4	(a,i,j)
Wild Tobacco	* <i>Solanum mauritianum</i>	Solanaceae	3 4	(a,b)

1.3. Vines & Climbers.

Common Name	Species Name	Family	Growth Stratum	Dispersal Mechanism
Edible Passionfruit	* <i>Passiflora edulis</i>	Passifloraceae	2 3 4	(a,b,h)
Corky Passionfruit #	* <i>Passiflora suberosa</i>	Passifloraceae	2 3 4	(a,b,h)
White Passionfruit #	* <i>Passiflora subpeltata</i>	Passifloraceae	2 3 4	(a,b)
Climbing Asparagus Fern ~ #	* <i>Protasparagus africanus</i>	Asparagaceae	2 3 4	(a)
Asparagus Fern ~ #	* <i>Protasparagus plumosus</i>	Asparagaceae	2 3 4	(a)
Climbing Nightshade	* <i>Solanum seaforthianum</i>	Solanaceae	2 3 4	(a)

5.3. Canopy.

The canopy has moderate species diversity largely comprised of mature phase and late secondary species. The common presence of early to late secondary stage species in the canopy and extensive vine thickets in the lower stratum are indicative of previous disturbance events such as selective logging or storm damage. The canopy health is generally good in the less disturbed sections of the forest. Canopy health deteriorates where canopy gaps (main gap to the north-west and south corner and edges) and canopy vine infestations exist (mainly *Flagellaria indica*). Smaller canopy gaps occur throughout the forest but are often filled by midstorey recruits. The canopy deteriorates towards the southern section of the remnant which becomes a narrow tongue of vegetation largely composed of vine thickets. Domination of gaps by vine thickets (including *Lantana camara*) is preventing the regeneration and repair of gaps. There are very few weed species in the canopy compared to the lower stratum.

Following the strategic control of vines and weeds from the lower stratum gaps and edges it is expected that the regeneration of these areas should be rapid (accompanied with maintenance) and will eventually suppress weeds in the lower stratum through shading out. The southern section of the remnant is more disturbed and will require a long-term maintenance programme to achieve successful dominance of the site by native canopy trees. Maintenance and promotion of a dense shade producing canopy is crucial in minimising the growth capacity of weeds in the understorey such as Wandering Jew and Asparagus Fern *Protasparagus plumosis*. Wandering Jew grows in the drains across the road and will continue to re-infest the site via dispersal during storm events. The weeds along both sides of the road should be controlled as part of the regeneration project.

Common canopy species include Red Apple *Acmena ingens*, , Incense Cedar *Anthocarapa nitidula*, White Booyong *Heritiera trifoliolata*, Black Bean *Castanospermum australe*, Native Tamarind *Diploglottis australis*, Black Apple *Planchonella australis*, Celerywood *Polyscias elegans*, Cudgerie *Flindersia schottiana*, Pepperberry *Cryptocarya obovata* and Red Ash *Alphitonia excelsa* common along the edges (see Appendix 2 for species list). Epiphytes are evident in the upper stratum but are uncommon. Native woody vines and climbers are present in all stratum and are causing minor problems in some areas, particularly edges and gaps.

Recommendations.

- Erect fence along north eastern edge of the remnant. Replace and/or repair fence along the south eastern section of the remnant.
- Promote canopy closure where gaps occur and mature phase recruitment in the lower stratum.
- Carry out systematic and thorough weed control through the canopy.
- Control all weeds in the understorey before removal of canopy tree weeds. This will reduce dense weed infestations in the understorey and promote mature phase recruitment in the lower stratum.
- Promote dense canopy, midstorey, understorey and edge development to provide shaded conditions that will disadvantage shade intolerant weed species.

Recommendations.

- Erect fence along unfenced side of remnant.
- Promote midstorey development, particularly on the edges and where gaps occur.
- Carry out systematic and thorough weed control through the midstorey.
- Control understorey weeds before removal of midstorey and canopy weeds. This will reduce dense weed infestations in the understorey and promote mature phase recruitment in the lower stratum.
- Promote dense canopy, midstorey, understorey and edge development to provide shaded conditions that will disadvantage shade intolerant weed species.
- Control all Vine Weeds (particularly Asparagus Fern) and Small-leaved Privet from this stratum (see Appendix 3).
- Strategic control and retention of some of the less serious canopy, midstorey and edge weeds is advised where Wandering Jew occurs to reduce light penetration to the understorey. Retained weeds should be removed when canopy, midstorey and edge development is sufficient to buffer harsh conditions. This will help to reduce weed growth, penetration of edge effects and the amount of follow up required.
- Judiciously control native vines that are deflecting midstorey development. Do not poison native vines, only cut them back to promote midstorey expansion.
- Where possible increase the size of the remnant especially along the eastern edge and southern section. Need to approach adjacent landholders. (See Section 4.2 on Remnant Management & Regeneration Philosophy for planting guidelines).
- Monitor regeneration, successional trends and weed infestations throughout the midstorey.
- Maintain a thorough, regular maintenance program. Follow up maintenance work is required for all previous restoration works to control re-establishment of weeds and promote natural regeneration.
- Conduct a thorough arboreal epiphytic and terrestrial fern and orchid survey.
- All restoration works should be carried out by trained rainforest regenerators using current techniques as those outlined in the Appendix 3.

5.5. Understorey.

Understorey health is variable throughout the remnant, often reflecting the condition of the canopy, midstorey and/or edge. Where the understorey is subject to high light levels, exposed to harsh edge effects and is dominated by weeds it displays a lower species composition. These problems are mainly evident in gaps and around the edge.

Ochna, Climbing Nightshade, Asparagus Fern and Climbing Asparagus Fern are sporadically distributed throughout the understorey, becoming more prevalent toward the edges. Where light is available Asparagus Fern and Climbing Asparagus Fern are starting to climb up into the midstorey and canopy. These weeds are not causing significant problems at present but are capable of smothering the understorey and midstorey which subsequently inhibits natural regeneration altering the structure and species diversity in the upper stratum.

Native vines, Lantana, Large-leaved and Small-leaved Privet and Wandering Jew dominate understorey gaps and edges where they are deflecting regeneration of seedlings. Wandering Jew occurs along the south western edge of the forest where it has dispersed from road drains. Increased moisture levels, higher light levels along

- Monitor regeneration, successional trends and weed infestations throughout the midstorey.
- Maintain a thorough, regular maintenance program. Follow up maintenance work is required for all previous restoration works to control re-establishment of weeds and promote natural regeneration.
- Conduct a thorough arboreal epiphytic and terrestrial fern and orchid survey.
- All restoration works should be carried out by trained rainforest regenerators using current techniques as those outlined in the Appendix 3.

5.6. Edge.

The edge displays the greatest degree of disturbance, density and diversity of weeds and impact from edge effects. Extra light, wind, runoff from road drains and continued dispersal of weed propagules favour weed species and native secondary species whilst creating harsh growing conditions. The southern edge is particularly susceptible to edge effects due to the narrow shape, early successional stage of development and high weed to native ratio.

Small dense thickets of Lantana occur sporadically along the eastern edge of the remnant. Lantana dominates a large gap on the north western edge. Both Privet species are common in the south eastern section of the remnant and along the edges. Exotic vines including both Asparagus Ferns, Passionfruit species and Climbing Nightshade are climbing up into the upper stratum along the edges. Wandering Jew is present along the western edge spreading out from the road drains. It generally penetrates no more than ten metres in from the edge.

The main weeds of concern along the edge are Wandering Jew, Lantana, Small and Large-leaved Privets, Asparagus Fern and Climbing Asparagus Fern. All thirty weeds identified from Willowbank are evident on the edge.

Native edge development is patchy. Some areas display a dense, thick native edge whilst in other areas native vines and weeds dominate the edge (mainly Lantana and Large-leaved Privet). The initial removal of weeds on the edge may increase edge effects until natives have re-established. Strategic retention or provision of a buffer along exposed edges will help reduce harsh edge effects. Native regeneration around the edge is expected to be relatively good due to the existing seedling recruits in the understorey and the existing soil seedbed around the edge. Natural regeneration along the edge will be enhanced if regular weed maintenance is undertaken.

Edge species include; Red Ash, Black Bean, Sweet Pittosporum *Pittosporum undulatum*, Creek Sandpaper Fig *Ficus cornoata*, Common Lillypilly *Acmena smithii*, Guioa *Guioa semiglauca* and Twin-Leaved Coogera *Arytera distylis*.

Recommendations.

- Erect fence along the north eastern section of the remnant. Re-place degrading fenceline along the south eastern section of remnant.
- Promote edge development, particularly where harsh edge effects and weed infestations deflect native regeneration and favour weed growth.
- Carry out systematic and thorough weed control along all edges.

- Strategic injection and/or retention of some of the less serious canopy, midstorey edge weeds and canopy vines especially along the eastern edge (where Wandering Jew is present) is advised to reduce light penetration to the understorey. Retained weeds should be removed when canopy, midstorey and edge development is sufficient to buffer harsh conditions. This will help to reduce weed growth, penetration of edge effects and the amount of follow up required.
- Locate and systematically control serious weeds from the lower stratum which are growing into the canopy (eg Asparagus Fern).
- Judiciously control native vines that are deflecting canopy development. Do not poison native vines, only cut them back to promote canopy expansion.
- Where possible increase the size of the remnant especially along the eastern edge and southern section. Need to approach adjacent landholders. (See Section 4.2 on Remnant Management & Regeneration Philosophy for planting guidelines).
- Monitor regeneration, successional trends and weed infestations in the canopy and any canopy gaps.
- Maintain a thorough, regular maintenance program. Follow up maintenance work is required for all previous restoration works to control re-establishment of weeds and promote natural regeneration.
- Conduct a thorough arboreal epiphytic and terrestrial fern and orchid survey.
- All restoration works should be carried out by trained rainforest regenerators using current techniques as those outlined in the Appendix 3.

6.2. Recommendations for the Midstorey.

- Erect fence along unfenced side of remnant.
- Promote midstorey development, particularly on the edges and where gaps occur.
- Carry out systematic and thorough weed control through the midstorey.
- Control understorey weeds before removal of midstorey and canopy weeds. This will reduce dense weed infestations in the understorey and promote mature phase recruitment in the lower stratum.
- Promote dense canopy, midstorey, understorey and edge development to provide shaded conditions that will disadvantage shade intolerant weed species.
- Control all Vine Weeds (particularly Asparagus Fern) and Small-leaved Privet from this stratum (see Appendix 3).
- Strategic control and retention of some of the less serious canopy, midstorey and edge weeds is advised where Wandering Jew occurs to reduce light penetration to the understorey. Retained weeds should be removed when canopy, midstorey and edge development is sufficient to buffer harsh conditions. This will help to reduce weed growth, penetration of edge effects and the amount of follow up required.
- Judiciously control native vines that are deflecting midstorey development. Do not poison native vines, only cut them back to promote midstorey expansion.
- Where possible increase the size of the remnant especially along the eastern edge and southern section. Need to approach adjacent landholders. (See Section 4.2 on Remnant Management & Regeneration Philosophy for planting guidelines).
- Monitor regeneration, successional trends and weed infestations throughout the midstorey.
- Maintain a thorough, regular maintenance program. Follow up maintenance work is required for all previous restoration works to control re-establishment of weeds and promote natural regeneration.

- Promote dense canopy, midstorey, understorey and edge development to provide shaded conditions that will disadvantage shade intolerant weed species.
- Control all Vine Weeds (particularly both Asparagus Ferns), Wandering Jew and Privet from this stratum (see Appendix 3).
- Strategic control and/or retention of some of the less serious canopy, midstorey and edge weeds is advised (particularly where serious understorey and edge weeds occur) to reduce light penetration to the understorey. Retained weeds should be removed when canopy, midstorey and edge development is sufficient to buffer harsh conditions. This will help to reduce weed growth, penetration of edge effects and the amount of follow up required.
- Strategically inject woody weeds that are in the canopy, midstorey and edge particularly where there is good natural regeneration potential in lower strata.
- Bag any fruits/seeds from Smooth Senna *Senna X floribunda* and Winter Senna *Senna pendula* var. *glabrata*.
- Where dense thickets of Privet species occur on the edge cut back and wait for regrowth to spray when actively growing (see weed Appendix 3). Hand weed around existing natives in preparation for spraying.
- Judiciously control native vines that are deflecting understorey development. Do not poison native vines, only cut them back to promote midstorey expansion.
- Maintain and prepare edges for extension/buffer planting and/or natural regeneration.
- Monitor regeneration, successional trends and weed infestations throughout the midstorey.
- Maintain a thorough, regular maintenance program. Follow up maintenance work is required for all previous restoration works to control re-establishment of weeds and promote natural regeneration.
- Conduct a thorough arboreal epiphytic and terrestrial fern and orchid survey.
- All restoration works should be carried out by trained rainforest regenerators using current techniques as those outlined in the Appendix 3.

7. CONCLUSION.

The main impacts associated with Willowbank are exacerbated by edge effects (wind and light penetration) and weed infestation. Weed infestations around the edges and in gaps require immediate attention and long-term maintenance and monitoring. Due to the limited size, narrow shape and isolated nature of Willowbank these impacts will remain unless the remnant is systematically regenerated and enlarged.

The main weed species of concern are Wandering Jew, Asparagus Fern, Climbing Asparagus Fern, Lantana, Small and Large-leaved Privet and Ochna. Attention needs to be paid to not create conditions that favour the establishment of weed species during the primary treatment, especially if regular maintenance is not guaranteed. Early control of vine weeds such as Asparagus Fern, Climbing Asparagus Fern and Corky Passionfruit will reduce the immediate seed source and the future workload required to remove these weeds.

- Floyd, A. 1990 b. *Australian Rainforests in N.S.W.* Volume 2, Surrey Beatty and Sons. Pty. Ltd. N.S.W. Australia.
- Fox & Adamson, 1990. Status and Impacts of Invasions in Different Systems, in *Kowari 2*, Longmore, R. (ed). Plant Invasions, the incidence of environmental weeds in Australia. A.N.P.W.S. Canberra.
- Frith, H.J. 1976. The Destruction of the Big Scrub in *Rainforests*. (ed) Goldstein, W. N.P.W.S. N.S.W. Sydney.
- Friend, J.A. 1987. Local decline, extinction and recovery: relevance to mammal populations in vegetation remnants, in *Nature Conservation: The Role of Remnants of Native Vegetation*, Saunders, D.A. et. al. (eds). Surrey Beatty and Sons. Pty. Ltd. N.S.W. Australia.
- Gosper, C. R. 1994. *Comparison of the Avifauna of Rainforest Remnants with Regrowth Dominated by the Exotic Tree Camphor Laurel*. Unpublished undergraduate report for partial fulfilment of the requirements for the Degree of Bachelor of Natural Resources. University of New England, Armidale.
- Grover, D.R. & Slater, P.J. 1994. Conservation Value to Birds of Remnants of *Melaleuca* Forest in Suburban Brisbane, in *Wildl. Res.*, 21.
- Haila, Y., Saunders, D.A. & Hobbs, R.J. 1993. What do we presently understand about ecosystem fragmentation?, in *Nature Conservation 3: The Reconstruction of Fragmented Ecosystems*, Saunders, D.A. et. al. (eds). Surrey Beatty and Sons. Pty. Ltd. N.S.W. Australia..
- Holmes, G. 1987. Avifauna of the Big Scrub Region, unpublished report for A.N.P.W.S. and N.P.W.S. N.S.W. Sydney.
- Hopkins, M.S. 1990. Disturbance - the Forest Transformer, in *Australian Tropical Rainforests*, C.S.I.R.O. Publications.
- Howe, R.W. 1984. Local dynamics of bird assemblages in small forest habitat islands in Australia and North America, in *Ecology* 65(5). Journal of the Ecological Society of America.
- Joseph, R. 1995. Rainforest Remnants Restoration and Rehabilitation Project, incorporating Plant Pest Species Survey and Prior Works Documentation, Andrew Johnston Big Scrub Nature Reserve, unpublished report for N.S.W. N.P.W.S. Lismore District.
- Kooyman, R.M. 1996. *Growing Rainforest, Rainforest Restoration and Regeneration*. Greening Australia, Brisbane. Qld.
- Kooyman, R.M. 1991. Rainforest Regeneration, Reforestation and Maintenance - Recommendations for the Far North Coast of N.S.W. in *Rainforest Remnants*, Phillips, S. (ed), N.S.W. National Parks and Wildlife Service, 1991.
- Leach, G.J. & Recher, H.F. 1993. Use of Roadside Remnants of Softwood Scrub Vegetation by Birds in South-eastern Queensland, in *Wildl. Res.*.
- Lott, R.H. & Duggin, J.A. 1993. *Conservation Significance and Long Term Viability of Subtropical Rainforest Remnants of the Big Scrub, North-eastern New South Wales*, Australian Heritage Commission and N.S.W. Department of Planning.
- Lovejoy, T.E. 1985. *Rehabilitation of Degraded Tropical Lands*. IUCN. Commission on Ecology. Occasional Paper, 5.
- Lynch, J.F. & Saunders, D.A. 1991. Responses of bird species to habitat fragmentation in the wheatbelt of Western Australia: interiors, edges and corridors, in *Nature Conservation 2. The Role of Corridors*. Saunders, D.A. et. al. (eds). Surrey Beatty and Sons. Pty. Ltd. N.S.W. Australia.
- Mezzatesta, R. 1992. 'Big Scrub' Rainforest Remnants Heritage Study. A Background Report for Nomination to the Register of the National Estate, unpublished report.

APPENDIX 2

Willowbank: Vegetation Species List.

SCIENTIFIC NAME	COMMON NAME	HABIT
ACANTHACEAE		
<i>Psuederanthemum variabile</i>	Pastel Flower	herb
AGAVACEAE		
<i>Cordyline rubra</i>	Red-fruited Palm Lily	palm
ANNONACEAE		
<i>Rauwenhoffia leichardtii</i>	Zig -Zag Vine	vine
APOCYNACEAE		
<i>Carissa ovata</i>	Current Bush	shrub
<i>Melodinus australia</i>	Southern Melodinus	vine
<i>Parsonsia straminea</i>	Common Silkpod	vine
<i>Parsonsia velutina</i>	Hairy Silkpod	vine
<i>Tabernaemontana pandacaqui</i>	Banana Bush	shrub
ARACEAE		
<i>Alocasia brisbanensis</i>	Cunjevoi	herb
<i>Pothos longipes</i>	Pothos	climber
ARALIACEAE		
<i>Polyscias elegans</i>	Celerywood	tree
ARECACEAE		
<i>Calamus muelleri</i>	Lawyer Vine	palm/vine
<i>Linospadix monostachyus</i>	Walking Stick Palm	
ASCLEPIADACEAE		
<i>Marsdenia suberosa</i>	Corky Marsdenia	vine
ASPLENIACEAE		
<i>Asplenium australisicum</i>	Birds Nest Fern	fern
BIGNONIACEAE		
<i>Pandorea jasminoides</i>	Bower Vine	vine
<i>Pandorea pandorana</i>	Wonga Vine	vine
BLECHNACEAE		
<i>Doodia aspera</i>	Rasp fern	fern
CAESALPINIACEAE		
<i>Caesalpinia subtropica</i>	Corky Prickle Vine	vine
CAPRIFOLIACEAE		
<i>Sambucus australasica</i>	Native Elderberry	shrub
CAPPARACEAE		
<i>Capparis arborea</i>	Brush Caper Berry	small tree
CELASTRACEAE		
<i>Cassine australis</i>	Red Olive Plum	small tree
<i>Celastrus subspicatus</i>	Staff Vine	vine
COMMELINACEAE		
<i>Commelina cyanea</i>	Commelina	herb
CUCURBITACEAE		
<i>Trichosanthes subvelutina</i>	Silky Cucumber R *	vine
CUNONIACEAE		

<i>Neolitsea australiensis</i>	Green Bolly Gum	tree
<i>Neolitsea dealbata</i>	White Bolly gum	small tree
LILIACEAE		
<i>Dianella caerulea</i>	Blue Flax Lily	grass
LOMANDRACEAE		
<i>Lomandra longifolia</i>	Spiny-head Mat-rush	rush
MELIACEAE		
<i>Anthocarapa nitidula</i>	Incense Cedar	small tree
<i>Dysoxylum mollissimum</i>	Red Bean	tree
<i>Dysoxylum rufum</i>	Hairy Rosewood	tree
MENISPERMACEAE		
<i>Carronia multisepala</i>	Carronia	vine
<i>Tinspora tinosporoides</i>	Arrow-head Vine R*,S*	vine
MIMOSOIDEAE		
<i>Archidendron muellerianum</i>	Veiny Laceflower R*	tree
<i>Pararchidendron pruinatum</i> var. <i>pruinatum</i>	Snowwood	tree
MONIMIACEAE		
<i>Doryphora sassafras</i>	Sassafras	tree
<i>Wilkiea austroqueenslandica</i>	Smooth Wilkiea	shrub
<i>Wilkiea huegeliana</i>	Veiny Wilkiea	shrub
MORACEAE		
<i>Ficus coronata</i>	Creek Sandpaper Fig	small tree
<i>Ficus fraseri</i>	Sandpaper Fig	tree
<i>Ficus obliqua</i>	Small-leaved Fig	tree
<i>Maclura cochinchinensis</i>	Cockspur Thorn	vine
<i>Streblus brunonianus</i>	Whalebone Tree	tree
MYRSINACEAE		
<i>Embelia australiana</i>	Embelia	vine
MYRTACEAE		
<i>Acmena ingens</i>	Red Apple	tree
<i>Acmena hemilampra</i> subsp. <i>hemilampra</i>	Broad-leaved Lillypilly	tree
<i>Acmena smithii</i>	Common Lilly Pilly	tree
<i>Austromyrtus bidwillii</i>	Python Tree	tree
<i>Ptilidostigma glabrum</i>	Plum Myrtle	tree
<i>Rhodamnia argenta</i>	Malletwood	tree
<i>Rhodamnia maideniana</i>	Smooth Scrub Turpentine R*	small tree
<i>Rhodamnia rubescens</i>	Scrub Turpentine	tree
<i>Syzygium hodgkinsoniae</i>	Red Lilly Pilly R*, S*	tree
<i>Syzygium luehmannii</i>	Riberry	tree
OLEACEAE		
<i>Notalaea johnstonii</i>	Veinless Mock Olive	shrub
PHILESIACEAE		
<i>Geitonoplesium cymosum</i>	Scrambling Lily	vine
PITTOSPORACEAE		
<i>Citriobatus pauciflorus</i>	Orange Thorn	shrub
<i>Hymenosporum flavum</i>	Native Frangipani	tree

<i>Duboisia myoporoides</i>	Corkwood	small tree
STERCULIACEAE		
<i>Brachychiton acerifolius</i>	Flame Tree	tree
<i>Commersonia bartramia</i>	Brown Kurrajong	tree
<i>Heritiera trifoliolata</i>	White Booyong	tree
ULMACEAE		
<i>Aphananthe philippinensis</i>	Native Elm	tree
<i>Trema aspera</i>	Native Lantana	shrub
URTICACEAE		
<i>Dendrocnide excelsa</i>	Giant Stinging Tree	tree
VERBENACEAE		
<i>Clerodendron floribundum</i>	Smooth Clerodendron	shrub/tree
<i>Gmelina leichhardtii</i>	White Beech	tree
VITACEAE		
<i>Cayratia clematidea</i>	Slender Grape	vine
<i>Cissus antarctica</i>	Water Vine	vine
ZINGERBACEAE		
<i>Alpinia caeruleavar arundelliana</i>	Native Ginger	
R* = ROTAP, S* = Schedule		

Faboideae	<i>*Erythrina X sykesii</i>	Coral Tree	Ringbark & inject with Tordon or Maverik (1:1.5) trial injection without ringbarking.
Oleaceae	<i>*Ligustrum lucidum</i>	Large-leaved Privet	Seedlings spray(1:50+LI700), Saplings CS&P (1:1.5), Trees frill/inject/spear (1:1.5). Dense infestations cut back to 30cm, hand weed around existing natives, wait for dense regrowth and spray (1:50=LI700).
Oleaceae	<i>*Ligustrum sinense</i>	Small-leaved Privet	Seedlings spray(1:50+LI700), Saplings CS&P (1:1.5), Trees frill/inject/spear (1:1.5). Dense infestations cut back to 30cm, hand weed around existing natives, wait for dense regrowth and spray (1:50=LI700).
Oleaceae	<i>*Olea europaea subsp. africana</i>	Common Olive	Seedlings-handpull or spray(1:50+LI700), Saplings CS&P (1:1.5), Trees- frill/inject/spear(1:1.5)
Araliaceae	<i>Schefflera actinophylla</i>	Umbrella Tree	Seedlings-handpull, Trees-CS&P (1:1.5)
Arecaceae	<i>*Syagrus romanzoffiana</i>	Cocos Palm/Queen Palm	Seedlings-handpull or crown, Chainsaw trees below growing point
SHRUBS			
Poaceae	<i>*Arundinaria spp.</i>	Creeping Bamboo	C&P (1:1.5), Regrowth- spray(1:50 +L.I 700)
Asteraceae	<i>*Baccharis halimifolia</i>	Groundsel	CS&P(1:1.5)-. Spray(1:50) well before flowering
Asteraceae	<i>*Chrysanthemoides monilifera subsp. rotundata</i>	Bitou Bush	CS&P or frill/inject/spear (1:1.5), Spray(1:200) can use salt water
Rubiaceae	<i>*Coffea arabica</i>	Coffee	Seedlings-handpull, Saplings-C,S&P (1:1.5), inject/spear(1:1.5)- between flower & fruit.
Verbenaceae	<i>*Duranta repens</i>	Duranta	CS&P(1:1.5), cut down & spray regrowth(1:100), inject(1:1.5)
Myrtaceae	<i>*Eugenia uniflora</i>	Brazilian Cherry	Spray (1:100+LI700), CS&P(1:1.5), frill/inject/spear(1:1.5)
Verbenaceae	<i>*Lantana camara</i>	Lantana	CS&P(1:1.5), brush hook & spray regrowth(1:100)
Rutaceae	<i>*Murraya paniculata</i>	Orange Jessamine	Seedlings-handpull or Spray(1:100+LI700), Saplings C,S&P (1:1.5), Trees frill/inject/spear(1:1)
Ochnaceae	<i>*Ochna serrulata</i>	Ochna	CS&P or frill/inject/spear(1:1.5), spray(1:50+LI700)
Myrtaceae	<i>*Psidium guajava</i>	Guava	Saplings-CS&P(1:1.5), Regrowth-spray(1:50+LI700), Trees- frill/inject/spear(1:1.5)
Euphorbiaceae	<i>*Ricinus communis</i>	Caster Oil Plant	Seedlings-handpull, Shrubs- brush hook & spray regrowth(1:100), or CS&P(1:1)
Caesalpinioideae	<i>*Senna pendula var. glabrata</i>	Winter Senna	Bag seedheads, Seedlings-handpull, Shrubs-CS&P(1:1) or frill/inject(1:1.5)
Caesalpinioideae	<i>*Senna X floribunda</i>	Smooth Senna	Bag seedheads, Seedlings-handpull, Shrubs-CS&P(1:1) or frill/inject(1:1.5)
Solanaceae	<i>*Solanum mauritanium</i>	Tobacco Bush	Seedlings-handpull, Shrubs-CS&P(1:1.5) or frill/inject/spear(1:1.5), Regrowth-spray(1:100+LI700)

LESS SERIOUS WEEDS.

Species with *** are either;

- known as serious environmental weeds in isolated locations.
- display the characteristics of a serious weed, or
- potentially could become a serious weed.

Family	Scientific Name	Common Name	Removal techniques:
VINES			
Polygonaceae	* <i>Acetosa sagittata</i>	Turkey Rhubarb ***	Dig up tubers. Glyphosate not very effective. Trial differing techniques.
Cactaceae	* <i>Hylocerus undatus</i>	Night Flowering Cactus	Hand remove and compost under black plastic.
Convolvulaceae	* <i>Ipomoea alba</i>	Moon Flower ***	Roll/rake, CS&P(1:1.5), spray(1:100 +LI700)
Convolvulaceae	* <i>Ipomoea purpurea</i>	Common *** Morning Glory	Roll/rake, CS&P(1:1.5), spray(1:100 +LI700)
Rubiaceae	* <i>Jasminum</i> spp.	Jasmine ***	Roll/rake, CS&P(1:1.5) nodes, spray(1:50 +LI700)
Faboideae	* <i>Pueraria lobata</i>	Kudzu ***	Slash or graze back where possible, trial CS&P(1:1) and spray ratios, shade out, don't plant for nitrogen.
Faboideae	* <i>Macroptilium atropurpureum</i>	Siratro	Slash or graze back where possible, trial CS&P(1:1) and spray ratios, shade out, don't plant for nitrogen
Passifloraceae	* <i>Passiflora foetida</i>	Stinking Passionfruit ***.	Vines-CS&P(1:1.5), Regrowth-spray(1:50+LI700)
Bignoniaceae	* <i>Pyrostegia ignea</i>	Golden Shower Vine	? CS&P(1:1.5), spray(1:50 +LI700)
Acanthaceae	* <i>Thunbergia alata</i>	Black-eyed Susan	?Roll/rake, CS&P(1:1.5), spray(1:50 +LI700)
Acanthaceae	* <i>Thunbergia grandiflora</i>	Sky Flower or Blue Thunbergia	?Roll/rake, CS&P(1:1.5), spray(1:50 +LI700)
TREES			
Araucariaceae	<i>Araucaria bidwillii</i>	Bunya Pine ***	Handpull seedlings, Saplings CS&P(1:1.5), Trees trial ringbarking & frill/inject/spear (1:1.5).
Rutaceae	* <i>Casimiroa edulis</i>	White Sapote	Trial - Seedlings spray(1:50+LI700), Saplings CS&P(1:1.5), Trees frill/inject/spear (1:1.5).
Rutaceae	* <i>Citrus limonia</i>	Rough Lemon	Seedlings spray(1:50+LI700), Saplings CS&P(1:1.5), Trees frill/inject/spear (1:1.5).
Moraceae	* <i>Ficus elastica</i>	Rubber Tree***	Trial different chemical injection. Dry cut wood off ground
Bignoniaceae	* <i>Jacaranda mimosifolia</i>	Jacaranda ***	Seedlings spray (1:50+LI700), Saplings CS&P (1:1.5), Trees frill/inject/spear (1:1.5).
Sapindaceae	* <i>Koelreuteria paniculata</i>	Golden Rain Tree ***	Trial - Seedlings spray (1:50+LI700), Saplings CS&P (1:1.5), Trees frill/inject/spear (1:1.5).
Magnoliaceae	* <i>Magnolia demodata</i>	Magnolia	Trial - Seedlings spray (1:50+LI700), Saplings CS&P (1:1.5), Trees frill/inject/spear (1:1.5).
Moraceae	* <i>Morus alba</i>	Mulberry	Seedlings spray(1:50+LI700), Saplings CS&P(1:1.5), Trees frill/inject/spear (1:1.5).Dry cut wood off ground
Pinaceae	* <i>Pinus elliotii</i>	Slash Pine***	Seedlings-handpull or spray(1:100+LI700), Saplings CS&P (1:1.5), Trees-frill/inject/spear(1:1.5)
Salicaceae	* <i>Salix</i> spp.	Willows ***	Seedlings spray(1:50+LI700), Saplings CS&P(1:1.5), Trees frill/inject/spear (1:1.5).Dry cut wood off ground

Iridaceae	* <i>Crocsmia X crocosmiflora</i>	Monbretia Crocsmia	Spray between flower and fruit (1:100 + Li700), hand pull, dig up bulbs-compost in black plastic
Caryophyllaceae	<i>Drymaria cordata</i> subsp. <i>Diandra</i>	Tropical Chickweed	Spray (1:100+LI700) or handpull. Shade out
Euphorbiaceae	* <i>Euphorbia cyathophora</i>	Painted Spurge ***	Handpull, bag flower heads, spray (1:100)
Asteraceae	* <i>Euryops crysanthemoides</i>	Euryops	Handpull, cut and spray regrowth (1: 100)
Asclepiadaceae	* <i>Gomphocarpus fruticosus</i>	Narrow-leaved Cotton Bush	Spray (1:100+LI700), slash or handpull
Acaathaceae	* <i>Hypoestes phyllostachya</i>	Freckle Face, Hypoestes ***	Crown or handpull, Spray (1:50+LI700).
Balsaminaceae	* <i>Impatiens wolleriana</i>	Balsam, Busy Lizzie	Spray (1:100). Shade out.
Liliaceae	* <i>Lilium formosamum</i>	Formosan Lily	?Hand pull, crown. Glysophate ineffective
Poaceae	* <i>Paspalum dilatatum</i>	Paspalum	Spray (1:100+LI700), slash or handpull/mattock
Phytolaccaceae	* <i>Phytolacca octandra</i>	Inkweed	CS&P(1:1.5), spray(1:100), slash or handpull
Lamiaceae	* <i>Prunella vulgaris</i>	Self Heal	Spray (1:100+LI700), crown or handpull
Lamiaceae	* <i>Salvia cocinea</i>	Salvia	Spray (1:100+LI700), crown or handpull
Liliaceae	* <i>Sansevieria trifasciata</i>	Mother-in-law's Tongue	Spray (1:100+LI700), handpull/mattock out
Poaceae	* <i>Setaria gracilis</i>	Slender Pigeon Grass	Spray (1:100+LI700), slash or handpull/mattock
Poaceae	* <i>Setaria sphacelata</i>	Setaria	Spray (1:100+LI700), slash or handpull/mattock
Solanaceae	* <i>Solanum capsicoides</i>	Devils Apple	Spray (1:100+LI700), slash or handpull
Solanaceae	* <i>Solanum nigrum</i>	Black-berry Nightshade	Spray (1:100+LI700), slash or handpull
Solanaceae	* <i>Solanum pseudocapsicum</i>	Jerusalem Cherry	Spray (1:100+LI700), slash or handpull
Asteraceae	* <i>Tithonia diversifolia</i>	Japanese Sunflower, Railway Daisy	?Spray (1:100+LI700) or handpull
Apocynaceae	* <i>Vinca major</i>	Periwinkle	?Spray (1:100+LI700) or handpull
Asteraceae	* <i>Wedelia trilobata</i>	Singapore Daisy	?Spray (1:50+LI700) or handpull (may be spray resistant to some extent)

C&P= cut and paint.

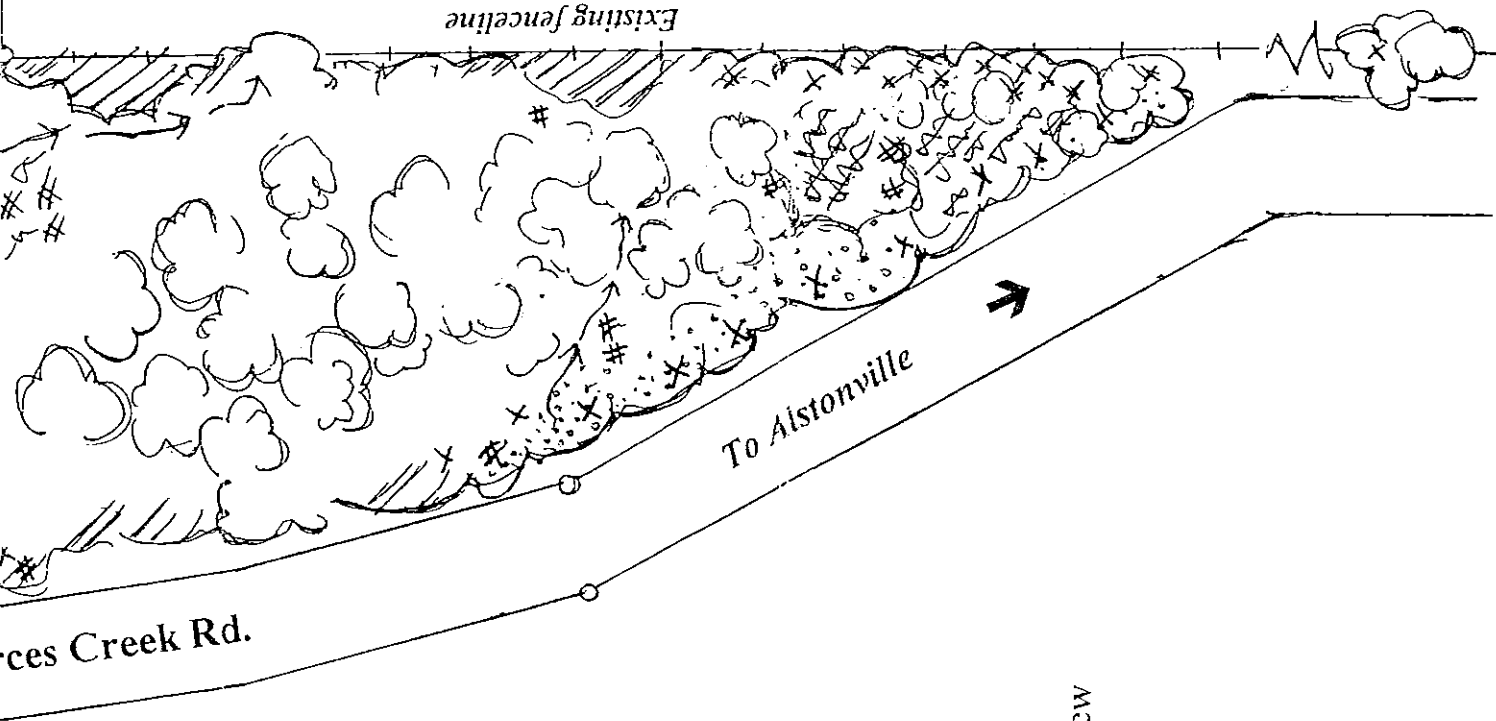
C, S & P= cut, scrap and paint.

Crown= knife out plants subterranean growth structures.

LI700= A penetrant added to spray for increased efficiency.

?= removal technique not adequately known at present.

- Systematically work along eastern and western edges of the remnant.
- If necessary strategically retain some of the less serious midstorey and edge weeds to reduce light penetration and harsh edge effects into the remnant core. Retained weeds should be removed when canopy, midstorey, understorey and edge development is sufficient to buffer harsh conditions. This will help to reduce weed growth, penetration of edge effects and the amount of follow up required.
- Systematically work in the southern section of the remnant. This section of the remnant is quite degraded due to past disturbance and subsequent domination of canopy trees by whip vine. Strategically inject all canopy and midstorey tree weeds where natural regeneration is expected to be good. Be careful not to create conditions that favours the growth and/or spread of weed species, particularly Wandering Jew, Asparagus Ferns and Lantana.
- Systematically eradicate all Asparagus Fern. Hand weed isolated infestations of Asparagus Fern otherwise cut and spray regrowth of *Asparagus plumosus*. Cut, gouge and paint corms of *Asparagus africanus*.
- Spray Wandering Jew, Privet and Asparagus Fern when they are actively growing with Glysophate at 1:50 with Li-700. The best time for spraying is after rain or during autumn. Follow up spraying may initially be required at up to 4-6 times in the first year.
- Control weeds as Wandering Jew on road opposite the remnant to reduce re-infestation of weeds through road drains.
- Commence systematic regeneration of the understorey and gaps.
- Maintain all previous works undertaken and spray weed regrowth.
- Spray Privet regrowth and seedlings when they are actively growing. Spray Wandering Jew, Privets and Asparagus Fern with Glysophate at 1:50 with Li-700 when activey growing. Follow up for these species will be required a few times per year.
- Monitor all regeneration works. Suggest setting up several fixed photo points. Put a picket at point photo is taken and another (or compass bearing) in the direction the photo is taken.
- Do not undertake works that can not be maintained.



ces Creek Rd.

Paddock.

Existing fence line

To Alstonville

Legend:

- # Asparagus fern
- /// Lantana
- x x Privet
- ~ Drainage line

- ⊗ Gaps / vine
- Road Drains
- ⋯ Wandering Jew

Scale: 1: 1000
 1cm = 10 metres
 Author : S. Bower
 March 1998

APPENDIX 5.

Conservation Code

- 2 The Distribution Category (can be 1, 2 or 3)
- 1 Known by one collection only,
 - 2 Geographic range in Australia less than 100 km,
 - 3 Geographic range in Australia greater than 100 km.
- K The Conservation Status (can be X, E, V, R or K)
- X Presumed Extinct: taxon not collected or otherwise verified over the past 50 years despite thorough searching in all known and likely habitats, or of which all known wild populations have been destroyed more recently.
- E Endangered: taxon in serious risk of disappearing from the wild within 10–20 years if present land use and other threats continue to operate. This category includes taxa with populations possibly too small (usually less than 100 individuals) to ensure survival even if present in proclaimed reserves.
- V Vulnerable: taxon not presently Endangered, but at risk over a longer period (20–50 years) of disappearing from the wild through continued depletion, or which occurs on land whose future use is likely to change and threaten its survival.
- R Rare: taxon which is rare in Australia (and hence usually in the world) but which currently does not have any identifiable threat. Such species may be represented by a relatively large population in a very restricted area or by smaller populations spread over a wide range or some intermediate combination of distribution pattern.
- K Poorly Known: taxon that is suspected, but not definitely known, to belong to one of the above categories. At present, accurate field distribution information is inadequate.
- C Reserved: indicates taxon has at least one population within a national park, other proclaimed conservation reserve or in an area otherwise dedicated for the protection of flora. The taxon may or may not be considered adequately conserved within the reserve(s), as reflected by the conservation status assigned to it. Where applicable, the 'C' symbol immediately follows the conservation status symbol in the written code, e.g. 2RC.
- i Size-class of all reserved populations (options are a, i or –)
- a 1000 plants or more are known to occur within a conservation reserve(s),
 - i less than 1000 plants are known to occur within a conservation reserve(s),
 - reserved population size is not accurately known;
- t Total known population reserved;
- + Overseas occurrence (included if the taxon has a natural occurrence overseas);
- P1 CALM Priority Flora Code (can be P1, P2, P3, P4 – see Appendix for definitions).

State and regional distribution and extent of reservation

- Ws State(s) or Territory in which the taxon still occurs (upper case), or where it once occurred but is now Presumed Extinct (lower case). Any one or more of the symbols WYSQNAV T or wysqnavt are possible: W = Western Australia, Y = Northern Territory, S = South Australia, Q = Queensland, N = New South Wales, A = Australian Capital Territory, V = Victoria and T = Tasmania.
- 6, 23 Regions of occurrence (can be in any of 1–80 regions; see Figure 1, p. 17).
- C The use of the C symbol in conjunction with a region number indicates that the taxon is reserved in that region (region 6 in this example).
- i Size-class of the total population within the reserve referred to (options are a, i or –). In this example, the size-class in Cape Arid National Park is less than 1000 individuals.
- x Indicates that the taxon is Presumed Extinct within a region (region 23 in this example).
- Cape Arid The name of a proclaimed reserve or other area dedicated to the protection of flora within which the taxon occurs in the region referred to (the taxon may occur within several reserves within a particular region and sometimes a reserve may extend across two or more regions).
- NP Indicates the class of reserve which is listed e.g. Nature Reserve, National Park, Heritage Agreement Area (in this example, National Park) (see Table 2, p. 15 for the key to conservation reserve types listed in this publication).