7.6 RECREATING APPROPRIATE SITE CONDITIONS

7.6.1 Soil Issues / Depth of Weed Cover, Compost and Litter

Comment has been made about the deep layer of composed garden waste, litter and other rubbish which occurs across the Subject Property, particularly in Management Zones 3 and 4 where only a few canopy trees remain *in situ* over a lawn overgrown with exotic vines and scramblers (see Plate 10). In these areas (Non-Core BGHF Habitat) the ground cover in is composed almost entirely of weed species, including dense infestations of the succulent Wandering Jew, Morning Glory Vine, Honeysuckle and other garden escapes.

A range of aggressive weeds have thoroughly colonized the rich moist substrate provided by the site's former land use (vegetable garden, chicken coop and compost area). It will be difficult, if not impossible, to remove these weeds by hand as the many of the species present readily fragment on contact and are capable of regenerating from even tiny pieces of stem or rhizome.

Plate 9: Former garden beds under BGHF canopy trees, but now a dense thicket of woody weeds, exotic vines and scramblers (Management Zones 2-3)

The only practical way to ensure total control of these ground cover weeds is to scalp the weed biomass and the underlying soil and to remove this polluted material from the site. A systemic herbicide such as glyphosate should be applied prior to scalping (to ensure that any weed residue is poisoned) and used again (as required) to treat weed regrowth as it occurs. Several applications may be necessary, although the cleared area is to be carefully monitored to identify any native species that may germinate, and if any such seedlings do occur, to make sure they are protected during follow-up weeding activities.

However, in the Core BGHF Habitat Areas – Management Zones 1 and 2 - where canopy trees (and some sub-canopy species) occur in close proximity to one another this approach may not be practical as there is always the possibility of damaging native vegetation. In such areas, progressive hand weeding, including the use of power tools such as chain saws, and the careful use of herbicide (see Appendix 5) should be used to remove woody weeds, introduced vines and scramblers and control unwanted ground covers.

If the overlying composed litter layer is removed; and light and air is returned to the forest floor, it is quite possible that some natural regeneration may occur as the underlying (weed free) soil may still contain some native seed, and given the opportunity, may regenerate. However, given the site's long history of disturbance it is unlikely that the native soil seed bank remains wholly intact.

If native species do regenerate naturally from the soil seed bank, or if they 'volunteer' into the site from elsewhere, these new plants will be incorporated into the bushland rehabilitation program proposed for the Core BGHF Habitat Areas (Management Zones Z 1 and 2), where they will contribute to species diversity. Given existing light levels and competition by existing canopy trees, it is however, unlikely that new canopy trees will be able to establish, with the possible exception of sites on the perimeters or in small clearings where there is less competition and where high light levels occur.

Given the site's long history of disturbance and alternative land uses, the natural regeneration of native BGHF species from either *in-situ* or *ex-situ* sources in those area designated as Non-Core BGHF Habitat Areas is unlikely to occur in sufficient abundance or with adequate floristic diversity, to recreate the BGHF Habitat (Management Zones 3 and 4). In such areas, it will be necessary to substantially reconstruct this Habitat via an intensive and on-going weed control program followed by a staged indigenous planting program.

Recommendations:

1. For Management Zones 1 and 2 (Core BGHF Habitat Areas) low impact bush regeneration methods and techniques should be used to remove weeds and other unwanted vegetation.
2. Where machine access is available, a small machine (with. low pressure tyres) may be used to scalp weed biomass and underlying weedy topsoil.
3. All scalped material should be removed off-site and deposited at a designated landfill site. At no time should weed debris and weedy topsoil (or compost) be retained for reuse elsewhere on the site – even in garden beds.

4. For Management Zones 3 and 4 and parts of 5 (Non-Core BGHF Habitat Areas), following the removal of all introduced trees and native trees in poor condition (primarily small to medium-sized Sweet Pittosporum), a small low impact machine should be used to scalp the weed biomass and the underlying soil to a depth of at least 10 cm. In some areas, the compost and litter will be up to one (1) metre in depth: all of this material should be removed and taken off site.
5. Where the proximity of significant native trees precludes the use of machinery, removal of the overlying weed burden will have to be removed by hand (thereby raising costs). It will be important to ensure that all weedy material and polluted soils are removed from the site before any replacement planting is undertaken.
6. Ideally, some time should be allowed to elapse after the site has been scaped and cleared of weeds. A period of at least two (2) months in warmer weather is recommended. This will allow any weed regrowth to be treated before planting is undertaken, thereby reducing maintenance weeding.
7. Carefully applied, the use of herbicide to control ground cover weeds is recommended. It is anticipated that follow up weeding will be required for several years at least after the weedy overburden is removed.
8. When applying herbicide as a foliar spray, care should be taken to avoid spray drift. Prior to spraying, the ground surface should be inspected to see if any native plants have regenerated. If any native seedlings are observed, they should be marked (tagged) and protected during weed control operations.

7.6.2 Recreating the Appropriate Community Structure

The general description given for the structure of BGHF (Tozer *et al.* 2006) is that it is "a tall eucalypt forest characterized by an open, mesic small tree/shrub layer and an open moist ground layer".

For a variety of reasons, including early clearing, the absence or overuse of fire, impact of local land uses, changes to local drainage patterns and fragmentation, densities in local BGHF bushland reserves have been dramatically altered, with a general lack of natives in the shrub and groundcover layers. It is therefore difficult to determine what planting densities are required to restore pre-disturbance conditions. See Section 8.5.3 for a discussion of appropriate planting densities and spatial arrangements for BGHF.

The table below compares the conditions in nearby BGHF reserves surveyed by UBM during the preparation of the VMP. The averages given are for native plant species only, and are based on the recorded structure for each stratum in a number of local bushland reserves. Similar % data is not available for Water Street, because apart from the tree canopy and a few scattered large shrubs, the native understorey is missing. This exercise has been undertaken in order to provide a guide to the % cover of native plants in each stratum; this being required to provide planting densities.

The Subject Property at Water Street Wahroonga has a much higher percentage cover in the small tree/shrub strata than nearby BGHF reserves – this being attributed to dense stands of woody weeds and (naturalized) exotic trees occurring. Site survey (see Table 7.4) indicates that the percentage cover listed for the groundcover stratum at Water Street is very high because this site has never

been weeded, while the bushland reserves surveyed have all undergone (or are currently undergoing) bush regeneration and weeding works.

Table 7.4: Table comparing the estimated % cover of each layer of vegetation at a range of sites in BGHF Reserves in Ku-ring-gai, compared to description by Tozer *et al*. 2006.

SITE	TREE CANOPY %	SMALL TREE %	SHRUB %	GROUND COVER %
The Glade Reserve	70	30	<10	90
William Lewis Reserve	50	-	<10	90
Nanowie Reserve	70	<10	20	90
Laura Osborne Houison Reserve	40	-	<10	70
Retaval School Reserve	40	-	<10	70
Average for sites surveyed by UBM	54	8		
Average for sites surveyed by Tozer *et al*.	25.7	34.3	44	41.4

Limitations: The % cover for shrubs in BGHF in the sites surveyed is somewhat higher than for the description provided by theTozer Report, but it is important to remember that only seven (7) reserves were surveyed, and of these, only 29% had a shrub layer (Tozer *et al*. 2006). It is also important to remember that all vegetation communities surveyed (being urban remnants) are in various stages of regrowth/recovery and will vary in structure. BGHF in Sydney has been highly disturbed, and this will have impacted on the structural integrity seen in such remnants today.

Recommendations:

1. The objective of the BGHF Habitat Rehabilitation and Reconstruction Program is to recreate an open tree canopy of locally indigenous species, including *Eucalyptus saligna*, *E. pilularis*, *Angophora floribunda* and *Syncarpia glomulifera*. Tree canopy projective foliage cover in the mature forest should be approximately 30-50%. Final canopy height would be expected to be 30-40 metres.
2. A sub-canopy of small trees/tall shrubs, approximately 10-20 metres in final height, should be established. As the sub-canopy stratum generally creates dense shade below, planting in groups will leave gaps for the establishment of ground cover species. It is expected that the initial density of this layer will be higher than 20 – 35% expected when plants are approaching maturity, reflecting the natural thinning which occurs in forest ecosystems.
3. The small tree species *Allocasuarina torulosa* should be planted with some discretion as they cast fairly dense shade and drop "needles" that may have an allopathic effect, suppressing groundcovers. However, these features could be used to help control weedy grasses and other unwanted groundcovers.
4. A small shrub stratum of approx 1-3 metres in final height should be established; with no more than 20% cover overall. Shrubs should be planted in groups to provide protective cover and food resources for native fauna, while allowing some gaps for the establishment of light-demanding ground cover species.

5. In areas with existing native groundcovers, or in locations where groundcovers are proposed to be established, planting densities of small tree and shrub species should be sparse; <10% cover to prevent over shading of the groundcover species.
6. A native groundcover of 0.1-1.2 metres in final height should be established; with a cover of 60% to 80%.
7. The aim should be to eventually establish a mosaic of groundcovers and plant litter which most closely reflects the patterns found in BGHF remnants of relatively good condition and structure.

Note: There is considerable variation within and between remnant stands of BGHF in species diversity, composition and vegetation structure. To reflect this natural variation, strata should be made up of 'naturalistic' species combinations and structural patterns devised to mimic the natural ecosystem of BGHF. It can be difficult to come up with a simple formula to achieve this when there are many local variations on most sites. To provide a 'loose' planting framework, species should be selected for different structural layers based on observations of species composition from nearby remnant stands of BGHF.

7.6.3 Recreating Appropriate Light Levels

Community structure and light levels are obviously strongly linked. In attempting to determine 'near natural' light levels for the reconstruction of a typical BGHF habitat, conditions in three (3) BGHF reserves in Wahroonga (within an ~5 kilometre radius) were inspected to provide some comparison with site conditions in the Subject Property. These reserves were chosen for comparative survey because in each one, a long-term bush regeneration program has been underway, and it is assumed that such works have gone some way to restoring a typical BGHF structure and floristic composition.

The BGHF tree canopy layer cover in five (5) local bushland reserves was assessed at a number of locations in each reserve, but overall averaged about 54% (see Table 7.4). The small tree stratum in some reserves was missing altogether or was very sparse. The light reaching the forest floor has promoted the dense growth of ferns, flowering forbs, native grasses and sedges (in moist conditions) Where light windows occur in canopy gaps, shrubs and young trees were noted.

In order to determine appropriate light levels for the rehabilitation and reconstruction of BGHF Habitat at Water Street, a Lux Meter was used to measure illumination (intensity of light level) at a number of different locations within the Subject Property. To provide a comparison of illumination in other 'recovering' BGHF Habitats, the Lux Meter was used at a number of locations within three (3) council-managed reserves. The results using the Lux Meter are presented in Table 7.3.

Table 7.3: Comparison of Illumination (in Lux) between the Subject Property and Other Local Bushland Reserves

	Water Street Core	Water Street Non-Core	The Glade	Clive Evatt	Hay-Dalrymple
No of Readings	6	4	4	3	6
Lux (average)	2,916	8,725	2,263	1,467	2,550

Note: all readings taken between 3.30 and 4.50 pm on a sunny day. Time of day will influence Lux levels

It is clear that light levels in most parts of Water Street are at this time unsuitable for the establishment of many of the characteristic BGHF species, and in order to rehabilitate and/or reconstruct suitable BGHF Habitat, appropriate structure and light levels will have to be remediated or restored. The following recommendations are made based on observation and the authors' knowledge of typical BGHF habitat conditions.

Recommendations:

1. In order to restore near-natural light levels, remove all introduced (non-indigenous) canopy trees from the area proposed for the rehabilitation of the BGHF Habitat (Management Zones 1 and 2), while retaining any of the significant plantings listed in Table 7.1.
2. A similar approach should be adopted in those areas proposed for the reconstruction of BGHF Habitat (Management Zones 3 and 4, and parts of 5).
3. Attempt to achieve a tree canopy/small tree stratum cover of no more than 40%, thus allowing filtered light to reach the forest floor.
4. Creating appropriate light levels may involve removing some of the medium to large-sized native *Pittosporum undulatum*, which tend to become weedy in areas which have not been burnt for many years. As a starting point, remove every third Pittosporum tree, targeting those which are growing with the canopy line of the mature BGHF trees.
5. All Pittosporum seedlings and young sapling should be removed during routine maintenance activities.
6. In undertaking enrichment and indigenous planting, it is important to be cognisant of the need to retain appropriate light levels, and when choosing species for indigenous planting programs, to consider the final height and width of the plantings at maturity.

7.7 NEED FOR ENRICHMENT PLANTING & ENHANCEMENT OF BIODIVERSITY

Removal of competitive garden plants and dense weed thickets will allow sunlight to reach the forest floor, hopefully stimulating natural regeneration of native seed in the soil seed bank. However, considering the site's long-term use as a managed landscape it is unlikely that natural regeneration will restore A full complement of BGHF species, or that floral recruitment into the site will occur in relative isolation from other floristically diverse areas of bushland.

In relying on recruitment from external sources, it must be recognised that dispersal of seed and other propagative material would have to take place across a highly developed suburban landscape, and while this is not impossible, such occurrences are unlikely to contribute substantially to natural regeneration within the Subject Property. Hence, it is anticipated that there will be a requirement to initiate an indigenous planting program to enhance local biodiversity and speed the recreation of fauna habitat within the Subject Property.

Section 8.3 Work Priorities, proposes to allow a minimum period of 12 months after initial weed removal *to establish trends in natural regeneration* for core BGHF Habitat in Management Zones 1 and 2 (considered to have a 'low to moderate' site resilience). After this time, a decision will be made about the need for, and the extent of, an enrichment planting program

Note: the decision to trial the regenerative potential (i.e. resilience) of the **Core BGHF Habitat Areas** for a minimum period of 12 months (thus delaying any planting) has been made because expert opinions as to the residual nature of the soil seed bank has varied so widely, and because the recent decision of the Land & Environment Court (April 2007) was at least in part, based on expert witness opinion that site resilience was likely to be high. It was therefore considered prudent to trial site resilience before adopting other measures to recreate the plant community.

For those **Non-Core Areas** where site resilience is considered to be 'low' or absent' due to long-term land uses and other disturbances (Management Zones 3, 4 and parts of Zone 5), reconstruction of the BGHF Habitat will be achieved by removing existing non-indigenous vegetation (horticultural plantings and lawns) and replanting the native understorey (mainly sub-canopy, shrubs and ground covers).

Recommendations:

1. Regular monitoring will be required to determine the extent and diversity of native species regenerating naturally (particularly in Management Zones 1 and 2). Monitoring and assessment should commence at the beginning of the program and be undertaken every six (6) months using the guidelines set out in Appendix 8. Results should be quantified, data analysed, trends established, and a short report prepared.

2. Following weed removal, monitoring over a period of 12 months should be adequate to establish regeneration trends. At this time, the need for, and extent of enrichment planting to increase local biodiversity and enhance habitat values should be determined.

3. Whether an indigenous planting program is undertaken as 'enrichment' planting to increase local biodiversity values (Management Zones 1 and 2) or to facilitate reconstruction of the BGHF Habitat (Management Zones 3, 4 and parts of Zone 5), the guidelines and protocols set out in Section 8.5 of the VMP should be followed.

4. A Concept Staged Planting Plan should be prepared early in the Program in order to identify likely future planting needs for all BGHF Habitat Management Zones. This Plan should prescribe plant species and plant numbers, planting densities and appropriate naturalistic placement.

5. An indigenous seed collection program should be commenced at the earliest possible time to allow adequate time for collection of a *diverse range* of BGHF species, and in order to anticipate planting requirements commencing in Year 2+ of the Program.

7.8 MANAGING EDGE SITES & INTERFACE ZONES

A discussion of the impacts of extended 'edge to core' ratios for small bushland remnants has been provided in Section 5.6.3 of the VMP. Such edge sites are said to provide an **interface zone** between bushland and another type of land use.

An interface between different land uses (sometimes described as a '**buffer zone'**) is usually a narrow strip of land between native vegetation and development or other adjoining land use. This interface may be topsoiled and turfed and include edged and mulched garden beds, lawns, roads and/or footpaths. Interface zones will vary in width, depending on land use types, and may contain non-porous surfaces. Any paved area in the interface zone should be graded so that water drains back into the development area.

It is this interface zone that is most vulnerable to the impacts of urban development. Such impacts include weed invasion and colonization by introduced garden plants and turf grasses; overland runoff (often containing fertilisers and other pollutants), tracking and damage to vegetation by walkers, incursion or 'mower creep' during routine maintenance activities; and activities such as rubbish dumping and disposal of lawn clippings.

Note: interface zones are often by default considered to be *de facto* bushland, and the land manager goes to lengths to exclude access, but it is important to acknowledge that management regimes for interface or buffer zones should be different to those applied to conservation areas (i.e. core bushland).

For example, in some situations it may be appropriate to under-scrub or mow this area as a bushfire protection measure; to maintain it as open parkland by removing shrubs or small trees; or it may be landscaped with non-invasive 'fire retardant' species (rather, those known to be marginally less flammable). Where bushland directly adjoins some form of development, it is essential that a managed buffer zone be established and managed appropriately.

Whatever landscape treatment is adopted, it must be recognised that the interface zone will usually have a high edge to core ratio, thus presenting an extended front (or edge) to the impacts of urbanisation. A higher level of site maintenance will therefore be required.

In the Subject Property at Water Street Wahroonga:

Some buffer zone plantings have been undertaken on the southern and south-western boundaries. These plantings were made in 2006 in order to provide a visual screen between the proposed (previous) development and neighbouring properties in Billyard Avenue and Plymouth Close. Most of these buffer plantings were made outside the designated (Non-Core) BGHF Habitat Area, but a small number were planted inside Management Zone 4.

The species used in the Buffer Planting were generally those found in the BGHF community, with two (2) exceptions – Lilly Pilly (*Acmena smithii*) and Black Wattle (*Callicoma serratifolia*). The composition of the Buffer Plantings will be adjusted if required, and incorporated into the Staged Planting Plan for BGHF Habitat.

Recommendations:

1. Interface zones along property boundaries should be maintained so that unwanted garden debris (prunings, lawn clippings) and dumped rubbish (dog droppings, timbers etc) are removed quickly, as a matter of priority.
2. Following on from the above, interface zones adjacent to property boundaries and in public view should be maintained for local landscape and amenity values, thus ensuring that the bushland is valued and cared for by local residents.
3. Where extended interface zones (edges) occur between bushland and open grassland (firebreaks, tracks, recreational areas), mowing/slashing should be carried out more frequently than that applied to grasslands which do not adjoin bushland reserves.
4. To provide a buffer in order to lessen edge impacts, consider planting the first 2-3 metres of the interface zone with a dense cover of small shrubs (< one [1] metre in height) and/or clumps of hardy native grasses or sedges. For those areas within or adjacent to the BGHF rehabilitation and/or reconstruction zones, the species used as buffer plantings should ideally be those occurring in the BGHF community (see Appendix 6).
5. Plant edge sites more densely (where more light is available) than core sites, using fast-growing shrubs and hardy native grasses or sedges to create an attractive visual buffer between the bushland restoration and public recreational areas.
6. The erection of permanent barriers (e.g. a pathway, treated logs or bollards) to provide a 'spray' or 'mowing edge' is strongly recommended at the interface. Where practical, introduced turf grasses (e.g. Kikuyu *Pennisetum clandestinum*, Buffalo *Stenotaphrum secundatum*) on edge sites and in canopy gaps should be eradicated (foliar spray), and replaced with hardy native grasses and ground covers, or (in the short term) by chipped eucalyptus mulch.

7. Where edge sites are paved or gravelled, they are to be graded so that water drains away from the bushland, and ideally runoff from hard surfaces should be directed into a spoon (or catch) drain. Path edges are best managed by a dense planting of low-growing native grasses or sedges (e.g. Kangaroo Grass *Themeda australis* or Spiny Matt-rush *Lomandra longifolia*), which will serve to intercept water flowing from the paved surface.

7.9 MANAGING TO MAINTAIN & ENHANCE FAUNA HABITAT

The value of the remnant and introduced vegetation within the Subject Property and in the Locality generally as habitat for native fauna has been discussed in Section 4.5.2 of the VMP. The real or potential impacts of the Proposal on those native fauna known to occur, or potentially to occur within the Locality, have been assessed. The issue of fragmentation (existing and potential) between stands of BGHF Habitat has also been addressed.

With the possible exception of a widespread interest in birds, restoring and managing native vegetation to provide habitat for locally occurring fauna is often overlooked. At the suburban: bushland interface, issues such as bushfire protection, access and the recreational needs of the community usually take precedence over the restoration of a structurally intact bushland understorey, which is critical for the habitat needs of all but the most disturbance tolerant fauna.

For example, the clearing of shrubs and dense understorey vegetation is recognised as an important factor in the loss of small birds from urban gardens and bushland reserves, and while the restoration of a native understorey is important, it is also important to recognise that opportunities to recreate such habitats in the urban environment are severely limited, not only by bushfire or related constraints, but by the loss (perhaps permanently) of local small bird populations.

The following mitigation measures have been provided to ensure that the redevelopment of the site does not have an adverse affect on those species recorded or potentially occurring within the Subject Property at Wahroonga. The following recommendations have been tailored to the life cycle needs of those native species recorded: these animals considered to act as 'umbrella' species[24].

The fauna species/groups recorded occupying the former John Williams Respite Centre site (as recorded 2005/2006), are as follows:

- Common Brushtail and Common Ringtail Possums;
- Grey-headed Flying Fox;
- Microchiropterans;
- Ground occupying reptiles;
- Urban tolerant birds; and
- One (1) nocturnal raptor.

[24] An umbrella species is an animal that has a specific habitat requirement, i.e. one that provides resources for a number of other species (NPWS 1997).

Recommendations:

To meet the needs of the listed species, recommendations to restore and enhance exiting fauna habitat are provided in Table 7.5, below.

Table 7.5: Fauna Habitat Needs & Recommendations for Enhancement

FAUNA SPECIES/GROUP RECORDED	REHABILITATION MEASURE RECOMMENDED
Common Brushtail Possum	Provide suitable nesting boxes (see below). Maintain suitable foraging resources through the planting of locally occurring native plants. Fencing around the property to restrict the influence of domestic predators (dogs and cats).
Common Ringtail Possum	Provide areas that support a medium to high density understorey layer. Dense plantings of native shrubs are required to meet the breeding/sheltering needs of this animal. Fencing around the property to restrict the influence of domestic predators (dogs and cats).
Grey-headed Flying Fox	Planting of locally occurring native plants that produce nectar, pollen and fruits.
Microchiropterans	Provision of suitably designed nesting boxes. Retention and promotion of a tree canopy. Planting of locally occurring native plants that produce nectar, pollen and fruits, thereby attracting a range of invertebrates upon which the microbats can feast.
Ground occupying reptiles	Provision of logs, natural debris and leaf litter accumulations. Provision of a moderately wide, (between 1 and 2 metres) shrub and ground cover layer that offer protection from “Increasers”. Provision of “natural” rubble (e.g. rocks). Fencing around the property to restrict the influence of domestic predators (dogs and cats).
Urban tolerant birds	Provision of a range of locally occurring native plants (including tree, shrub and ground cover species). Fencing around the property to restrict the influence of domestic predators (dogs and cats).
One (1) nocturnal raptor.	Retention and promotion of a tree canopy. Provision of a range of locally occurring native plants (including tree, shrub and ground cover species) that attract insects upon which this species can forage.

In addition to the recommendations presented above, to compensate for the loss of a percentage of the habitats present (through removal of weed thickets and introduced horticultural specimens), and to provide resources for any individuals displaced due to the redevelopment of the site, it is recommended that 15 suitably designed nesting boxes be erected.

These nesting boxes should be:

- Erected prior to the development of the Subject Property; and
- Designed to meet the sheltering and breeding needs of a variety of hollow dependant native species including birds, insectivorous bats and arboreal mammals.

The nesting boxes should be located within the eucalypt woodland, an environment where hollows are limited, but foraging resources are available.

These nesting boxes should be erected by a suitably qualified ecologist; thereby ensuring their correct orientation and placement. The locations of the nesting boxes should be mapped to ensure their positions are known when considering the sighting of any ancillary structures or work compounds.

The nesting boxes should be monitored for a minimum period of two (2) years. The monitoring program should be undertaken at quarterly intervals and results included in the Annual Progress Reports (see Section 8.8).

Monitoring should be conducted to:

1. Identify the level of occupation and the diversity of species present; and
2. Negate and manage the occupation of the nesting boxes by exotic species (e.g. European Honey Bees).

If nesting boxes are identified as being damaged or removed, these should be replaced.

Table 7.6: Summery of Management Issues, Recommended Strategies, Actions, Roles & Responsibilities

*Timeframe Key

ST – 0-2 years

MT – 2 – 5 years

LT – 5 – 10 years

MANAGEMENT ISSUES	RECOMMENDED STRATEGIES & ACTIONS	RESPONSIBILITY	TIMEFRAME FOR ACTION *
Threatened Species Legislation	Protect all areas identified as BGHF Habitat (Figure 2.1) Implement recommendations of VMP for bushland rehabilitation. Protect threatened specimens of Magenta Lilly Pilly from impacts of construction and garden refurbishment Refrain from planting any species listed as 'threatened' under State and/or Federal government legislation	Landowner - W@W As advised by Murlan Project Managers and/or Consulting Restoration Ecologist	ST ST On-going
Potential Impacts of Development & Damage to Bushland During Construction **Runoff & Drainage**	Identify and fence off all areas of BGHF Habitat Site induction for all personnel Appoint a Project Manager and qualified ecological restoration consultant to oversee implementation of VMP Prepare and implement a soil and water management plan prior to commencement of works Ensure local drainage patters are not changed where they impact on areas of BGHF Habitat	Murlan Project Managers, Construction / Site Manager	ST (prior to commencement of works) On-going, as required ST On-going
Fragmentation	Retain canopy and sub-canopy native trees wherever possible. Replant and/or reconstruction BGHF Habitat through an indigenous planting program, incorporating some shrubs	Murlan Project Managers with Landscape Architect	ST to MT MT to LT

MANAGEMENT ISSUES	RECOMMENDED STRATEGIES & ACTIONS	RESPONSIBILITY	TIMEFRAME FOR ACTION *
	and a high number of native ground covers. Where impacts of development remove such trees, replant with same species in order to retain linkages through the site and to adjacent stands of trees		MT to LT
Weed Invasion	Target WONS & declared noxious weeds in first instance – remove throughout property Remove weeds listed in Table 5.1 from all BGHF Habitat areas	Bush Regeneration Contractor, monitored by Restoration Ecologist	ST MT
Restoring/Rehabilitation of BGHF Habitat	Weed Control followed by monitoring of native plant regeneration Assessment of progress at 12 & 18 months Decision to plant to increase biodiversity and fauna habitat to be undertaken at this time, depending on results of monitoring program	Bush Regeneration Contractor, landscapers Murlan Project Managers, advised by Consulting Restoration Ecologist	MT to LT
Weed Control	As above		
Protection of Culturally Significant Trees	Identify significant trees / plantings to be retained GPS locations and identify on site map: induct all personnel Erect trees shields and exclusion fencing	Landscape Architect, Consulting Restoration Ecologist	ST
Enrichment Planting	Use only locally occurring native species (i.e. characteristic of BGHF) when replanting (see Appendix 6). Ensure density conforms to near-natural BGHF structure (Table 6.2)	Landscape Architect	MT - LT
Fauna Habitat - Management &	Retain linkages thorough the canopy and sub-canopy	Landscape Architect	ST to MT

MANAGEMENT ISSUES	RECOMMENDED STRATEGIES & ACTIONS	RESPONSIBILITY	TIMEFRAME FOR ACTION *
Enhancement	Remove weeds in mosaic fashion to ensure protection of exiting habitat provided by weed thickets Reinstate some areas of dense shrubbery: some areas of open grassland to provide diverse habitat niches Ensure weeding techniques do no impact unnecessarily on fauna habitat and fauna needs.	Bush Regeneration Contractor Bush Regeneration Contractor	
Monitoring & Assessment	Determine extent and duration of monitoring program Install transects/quadrats & photo-points for monitoring program Monitoring and reporting to be an integral part of the BGHF Rehabilitation and Reconstruction Program	Consulting Restoration Ecologist, with assistance from Bush Regeneration Contractor	Establish at commencement of works to MT On going

8 IMPLEMENTATION & REVIEW

8.1 POLICY & PERFORMANCE

The policies established in this VMP provide a management framework consistent with the site's potential for natural regeneration (as determined by ecological constraints), seasonal or climatic conditions prevailing, the availability of resources for on-ground works, and after consultation with DECC and the Bushland Management Officer Ku-ring-gai Council.

The priority tasks to be carried out are outlined in Section 8.3, below. However, unless adequate resources are available over the lifetime of the VMP, some of the objectives listed for the Blue Gum High Forest Habitat Rehabilitation and Restoration Program may not be realised.

8.2 REVIEW

This VMP for is designed to cover a period of 10 years. At the halfway point (i.e. five [5] years) the Plan should be reviewed; outcomes of the BGHF Rehabilitation and Reconstruction Program assessed using the Performance Indicators outlined in Section 8.9; and changes or adjustments made as necessary.

After Year 5, an updated flora survey should be commissioned, with species densities, frequency of occurrence and abundance (% cover) evaluated in all Management Zones. Wherever possible, shifts in the floristic composition and/or structural integrity of the vegetation community should be quantified, and any obvious trends identified.

A comprehensive fauna survey and evaluation of existing fauna habitats should also be undertaken at the end of Year 10. Analysis of survey results should be used to confirm or adjust the bushland management strategies set in place by the VMP.

8.3 WORK PRIORITIES

Key actions and tasks to be undertaken to implement the BGHF Habitat Rehabilitation & Reconstruction Program are listed in order of priority, and are illustrated in a Gantt chart format in Table 8.3.

In identifying a sequence of works for the BGHF Rehabilitation & Reconstruction Program for the Subject Property at 35 Water Street, the VMP gives first priority to protecting and regenerating those areas of highest species diversity (parts of Management Zones 1 and 2) where some degree of site resilience is anticipated. This will be achieved using a 'traditional' Bush Regeneration approach (see Section 6.2). This approach will be trialled for a period of 12 months, after which time a quantitative analysis of site response will be undertaken.

If site analysis indicates that 'low-key' non interventionist methods (i.e. Natural Regeneration) are successful in encouraging the establishment of a *wide range* of indigenous species, in appropriate numbers, this approach should be continued. However, if natural regeneration is slow to occur or otherwise disappointing (i.e. low diversity and abundance), other approaches to bushland rehabilitation, including an indigenous planting program should be considered (i.e. Assisted Natural Regeneration)

As second priority, the Program will then address areas of 'low' species diversity, where site resilience is correspondingly 'low' or even 'absent'. Weed control and removal of all unwanted vegetation will be followed by thorough site preparation and a broad-scale indigenous planting program.

In summary, indigenous planting is proposed for areas of 'moderate to low' diversity (Management Zone 1 and 2) on a 'needs only' basis. After these areas have been successfully established, this strategy will be extended into areas where there are few or no native plant species (Management Zones 3, 4 and 5). In effect, the BGHF Habitat in the latter areas will be reconstructed, not regenerated.

Planting needs for Management Zones 1 and 2 will be assessed at the end of Year 1 (@ 12 months), but planting needs for Management Zones 3 and 4 (where reconstruction strategies will be required from the outset), should be addressed early in the Program.

It is recommended that a Staged Concept Planting Plan for areas of Reconstructed BGHF Habitat (Management Zones 3, 4 and 5) should be prepared so that planting needs are identified and resourced at the outset.

This VMP has been designed to cover an initial 10-year period. A comprehensive review of outcomes, assessed against identified project goals and objectives is recommended at the end of Year 5 of the Program.

8.4 PROTOCOLS FOR WEED CONTROL

All plants declared as Weeds of National Significance ('**WONS**') and plants declared as Noxious Plants in the Local Control Area to be controlled as a matter of priority – this is described as 'targeted weed control'.

Targeted weed control is required to control and eventually eradicate WONS and declared noxious weeds. The weeding program should then address the control of the keystone environmental weeds recorded for the Subject Property (see Table 7.2). A list of priority target weeds has also been set out in Appendix 5, along with recommended control methods.

Maintenance weeding will necessarily be on-going in all Management Zones after the conclusion of initial primary and follow-up weeding. All regenerating sites are to be monitored and weed regrowth treated as necessary. High levels of maintenance weeding can be anticipated in the growing season; late spring to mid-autumn.

Note: that most of the berry-fruited weed varieties bear ripe fruit from late summer to late autumn (e.g. Privet, Ochna, Cotoneaster, African Olive). Adherence to a species-specific, seasonal weeding calendar will ensure that such weeds are controlled prior to fruiting and seeding.

The long-term nature of a bush regeneration program is cannot be over-emphasized. Following completion of initial works (which is expected to take up to and possibly more than 10 years); maintenance weeding will be required – realistically in perpetuity - to keep the area acceptably free of priority target weeds.

The number of sessions required for effective maintenance of the BGHF Habitat Areas will depend very much on site conditions, the response of the vegetation community to the methods employed, and the input of weed propagules and other impacts from adjoining or nearby land. The possible impacts of climate change cannot be overlooked, particularly if these changes involve warmer and/or wetter seasons, which will favour weed growth.

Management for species diversity (e.g. culling of dense native vegetation, selective replanting) and management of the bush fire hazard (if such exists) should be carried out yearly, and these tasks will require a further level of resources.

8.5 PROTOCOLS FOR REVEGETATION

The following guidelines are basically generic in nature, but they have been included in this VMP as an aid to implementing an indigenous BGHF planting program in the Subject Property at 35 Water Street Wahroonga.

8.5.1 Site Preparation

Soil Conditions

The success of any planting program is largely dictated by site conditions, and particularly the structure and chemical composition of the site soils. Prior to planting, a series of basic soil tests should be carried out using one of the proprietary soil testing kits available commercially. Despite the costs involved in carrying out basic soil tests, the whole program could fail if the soil proves to be unsuitable for planting with native species[25].

If the soil pH or salinity levels are outside the 'normal' range (read product label), advice on soil remediation should be sought from a qualified horticulturalist or landscape gardener. The local office of the NSW Department of Primary Industries (located at Richmond NSW) may also be able to offer practical advice.

If imported (or fill) soils already *in situ* on the property are suspected of being contaminated in some way, soil samples should be sent to a professional laboratory for analysis. Similarly, if site soils are

[25] That is, soil may be too high in plant nutrients, particularly Phosphorus (P) or Nitrogen (N); too high in clay content, or it may contain micro or macro pollutants.

thought to contain asbestos or a similar macro-pollutant, the contractor should contact Ku-ring-gai Council's Environment Unit or the Health Department without delay.

In the Subject Site at Water Street Wahroonga

Altered soil profiles were noted to occur adjacent to Young Street (piles of clay fill) and over a large area behind the Stables and extending to the southern property boundary (former vegetable garden/compost and service areas). The Croquet Lawn, which has been subject to cut and fill, would have been regularly regraded, and top-dressed with imported soil.

Of the three (3) areas mentioned above, the most problematic for restoration purposes will be the area behind the Stables where soils have been cultivated and enriched over many years. Part of this area has been identified by Smith & Smith (2006) as 'potential' BGHF, and is designated in the VMP as Management Zone 4.

8.5.2 Selection of Appropriate Flora Species

In selecting species for planting in bush regeneration sites, a number of issues must be considered. The species proposed for planting should NOT simply be chosen from a broad selection of native plants known to occur in the locality, but should be:

- Representative of the locally occurring native vegetation community (here, BGHF);
- Readily obtainable from a reputable plant nursery; or easily propagated by seed collected from existing local material;
- Niche-specific, i.e. suitable for planting in existing habitats and micro-habitats;
- Hardy and tolerant of variable soil conditions, and easy to establish under open or difficult field conditions;
- Be of appropriate size (height/breadth) to achieve an appropriate balance in the proportion of trees and shrubs and groundcovers in the replicated vegetation community;
- Provide a range of habitat, foraging and shelter sites for native fauna (especially around high-usage sites such as ponds and open grasslands);
- On edges and interface sites between bushland and development, be carefully selected so as to create an effective 'buffer planting' between designated BGHF Habitat areas, development and private property boundaries; and when
- Planting in buffers and interface sites, should attempt to utilise fire-retardant species (or those with reduced flammability), with planting made at reduced densities and with a simplified structural form[26].

The choice of species for BGHF areas as set out in the Landscape Plan (Taylor Brammer January 2009) has been made with reference to the requirements of the VMP.

[26] See publications from the Rural Fire Service or view their website (rfs.nsw.gov.au).

8.5.3 Planting Densities and Spatial Arrangement

When reconstruction (revegetation) programs are planned, this altered ratio is often taken as 'the norm', with the result that planting densities are skewed towards high numbers of shrubs and trees.

The objective of the BGHF Habitat rehabilitation and reconstruction program at Water Street Wahroonga is to restore (as far as possible and practicable) a semblance of the original vegetation community. Therefore the BGHF restoration program should consider that under 'natural' conditions, the mid-storey or shrub layer of the BGHF is naturally moderate to sparse, and the tree canopy/small tree layer generally does not 60% foliage cover.

Planting densities should be based on the final size of the relevant species used. For example, larger species may also be planted in groups of three (3), five (5) or seven (7), but should be placed sufficiently close together to enable a moderately dense cover to form (where this is appropriate, and will not suppress light-demanding groundcovers).

Small-sized plants (generally less than 500 millimetres in height) should be planted in groups at a density of approximately three (3) to five (5) units per sq metre.

The approximate planting densities recommended for each Management Zone set out in Table 8.3, below. However, in making these recommendations it must be understood that rigid prescriptions can become too complicated without achieving any significant benefit. The suggestions presented below for establishing a 'near-natural' plant community structure have been prepared to provide some guidance for reconstruction planting.

Table 8.1: Indicative Planting Densities

STRATA	EXISTING BGHF HABITAT M ZONE 1	EXISTING BGHF HABITAT M ZONE 2	RECONSTRUCTION BGHF AREA M ZONE 3	RECONSTRUCTION BGHF AREA M ZONE 4	RECONSTRUCTION BGHF AREA M ZONE 5
	2,600 sq metres (per UBMC 2006)		3,750 sq metres (extra areas per Smith)		1770 sq metres (per Taylor Brammer 2009)
Tree Canopy	1 unit/20m^2 - gaps only	1 unit/20m^2 - gaps only	1 unit/20m^2	1 unit/20m^2	1 unit/20m^2
Sub-canopy / Small Trees & Large Shrubs	1 unit/10m^2	1 unit/10m^2	1 unit/10m^2	1 unit/10m^2	1 unit/10m^2
Small/Medium Sized Shrubs < 3m	1 unit/5m^2 - plant in clumps of 3-5	1 unit/5 m^2 - plant in clumps of 3-5	1 unit/5m^2 - plant in clumps of 3-5	1 unit/5m^2 - plant in clumps of 3-5	1 unit/5m^2 - plant in clumps of 3-5
Ground Covers	4 units /1 m^2	4 units /1 m^2	4 units/1 m^2	4 unit/1 m^2	4 unit/1 m^2

Note: the importance of allowing for the presence of existing (*in-situ*) native vegetation when determining number of plants required in a planting program. This is often overlooked, with the result that the planting site is crowded out, and as a result, tubestock is often placed in inappropriate locations, such as in the shade of other, larger plants.

8.5.4 Seed Collection

Collection Sites

It should be possible to obtain appropriate plant material from specialist native plant nurseries or from a nursery recommended by the Bushcare Officer at Ku-ring-gai Council. Otherwise, it will be necessary to collect indigenous seed and other propagative material from other parts of the Subject Property and from local bushland, preferably within a 10-kilometre radius and exclusively from the BGHF Ecological Community.

Seed collected should represent a range of plant types, and include canopy trees, sub-canopy trees, shrubs and ground covers. When collecting seed, donor sites must be matched to recipient sites: i.e. soil type, moisture levels, aspect and vegetation community types must correspond as closely as possible.

Local seed collection and planting with locally-occurring native species will help to preserve genetic integrity and retain local landscape character. If collecting seed from public reserves, permission must first be obtained from the relevant council or land management authority.

Local reserves where appropriate species may be found are those indicated in Tables 7.3 and 7.4.

Note that written permission from Ku-ring-gai Council must be obtained before any seed collection or taking of cuttings from native plants is carried out.

Seed Collection Guidelines

Seed collection, processing and storage should follow the *Flora Bank Seed Collection Guidelines* (National Heritage Trust / Bushcare /Greening Australia 2002), which are found at www.florabank.org.au.

8.5.5 Planting Aids

Plant Fertilisers

A specially formulated native plant fertiliser (low in phosphorus) such as 'Osmocote Purple' should be used when planting native tubestock. Regular applications of dilute fertiliser should be used twice yearly (spring and early autumn), or when plants show signs of yellowing or spindly growth (at least until the plants become established and drought hardy).

The use of a plant fertiliser is recommended to assist plant establishment in the first 6-12 months of the planting program. As the vegetation cover is re-established, and organic matter is re-cycled into the topsoil, there will be less need for supplementary nutrient input.

Complete native plant fertilisers are available in granular form or as tree tablets. Soluble fertilisers are preferable to granular forms, although tree tablets (or pellets) may also be useful when planting advanced specimens.

Water Retaining Granules/Soil Wetters

Products such as Debco, Saturaid, Terracottem (or similar) should always be used in harsh conditions and/or where post-planting watering may be a problem, and they are particularly useful in free-draining sandy soils. In dry season or drought conditions, no planting should be undertaken without the use of water retaining granules or soil wetters.

These products are inert, and do not react with fertilisers or herbicides. If used at planting time, watering times can be reduced by up to 50%. Experience using such granules in bush regeneration sites in the Sydney Region has allowed a greater survival rate than previously achieved.

In the Subject Property at Wahroonga:

All plantings undertaken in the BGHF Habitat Areas should be made using the planting aids listed above.

Mulching and Weed Matting

Mulch is crucial to the success of most planting projects as it keeps the soil cool and moist and suppresses weed growth. Mulching around planted tubestock can utilise chipped eucalypt mulch or if costs allow, commercial 'leaf mulch' may be used.

Chipped or mulch from woody weed sources are never acceptable. All imported mulch must be of known provenance and certified weed-free. Alternatively, it is possible to foliar spray dense weed grasses with a selective herbicide (e.g. Fusilade) and to leave the dead thatch in place as mulch[27].

Mulch must be applied at the time of planting, after thorough soil wetting. When planting in large open areas, plants should be grouped to allow mulch to be applied around each 'planting island' or cluster. This reduces edge effects (e.g. weed invasion, drying), and makes plant maintenance easier.

Weed Matting (such as Jutemaster, Enviromat, coconut fibre) is useful for retaining soil moisture and suppressing weed growth. Individual weed mats may be used around each plant at planting time, or broad-scale weed matting can be installed over a large area. If the latter approach is used, the matting must be firmly anchored with long metal pins.

Note: mulch should never be used in bushland where natural regeneration from the soil seed bank is anticipated – i.e. where site resilience is judged to be moderate to high. Thick mulch will suppress the germination of many locally indigenous plants, which in the main are sclerophyllous (hard-leaved) species, while favouring only those species with largest seed – these generally being native gully or mesic species such as Sweet Pittosporum *Pittosporum undulatum* and Bleeding Heart Tree *Omalanthus popufolius* – and resulting in a 'mesic shift' in site floristics.

If used inappropriately over a long period of time, the placement of thick mulch can impact on site floristics and encourage a shift to a mesic vegetation type, and inadvertently create optimal conditions for the growth of shade tolerant weeds such as *Ligustrum* spp (Privets), Wandering Jew *Tradescantia fluminensis,* and Asparagus 'Fern' *Asparagus aethiopicus.*

Note also: weeds will grow in most types of mulch and on the surface of weed matting, but seeds beneath are prevented from germinating. Most grasses and bulb species have sharp leading shoots (new growth) that can pierce loosely spun weed mats and grow through them.

In the Subject Property at Wahroonga:

Mulch mats or chipped leaf litter should be used only around individual plantings in those areas with some potential for natural regeneration (MZ 1 and 2). In the BGHF reconstruction areas where there is very little potential for *in situ* regeneration (MZ 3, 4 and 5), it will be necessary to apply mulch over a larger area to suppress weed growth and retain soil moisture. Mulch will deteriorate over time, and must be topped up or replaced on a regular basis.

8.5.6 Irrigation

It may not be practical to water the planting sites over a long period, and given current water restrictions, the planting program should be planned to coincide with the period of maximum (and regular) rainfall. In the Sydney Region, optimal planting time is mid to late autumn. Spring planting is feasible provided that adequate irrigation is available over the hot summer months.

[27] A systemic herbicide such as glyphosate is not recommended as a foliar spray to control grasses where other native plants are growing as this product is non-specific.

It is also important to ensure adequate watering at planting, applying 1-1.5 litres of water to each new plant. Additionally, the use of a water-retaining compound and some form of surface mulch are strongly recommended to retain soil moisture and decrease the need for on-going watering.

Plants should be soaked for at least 30 minutes prior to planting (before being removed from their pots), watered thoroughly at planting and thereafter, watered once each week for a period of four (4) weeks (weather conditions dictating frequency). After this period, watering comprising one (1) litre of water / plant each month will be required until the plants have established.

If current drought conditions prevail, a permanent watering period may have to be extended to ensure plant survival. A drip irrigation system is best and (unless guidelines change) complies with Sydney Water restrictions on watering gardens. Watering is best carried out in the early morning as watering at dusk encourages fungal attack in some species.

Alternatively, as plant establishment is dependent on good follow-up rains, it may be prudent to delay planting until such time as climatic conditions improve, and/or a permanent irrigation system can be set in place.

In the Subject Property at Wahroonga

The installation of a fixed irrigation system in the BGHF reconstruction areas (MZ 3, 4 and 5) is recommended to provide regular irrigation in the initial stages of the reconstruction (planting) program. After plantings have become established, the irrigation system can be dismantled, removed and used elsewhere.

8.5.7 Revegetation Methods

Tubestock Planting

Planting 'forestry tubes', hykos (small tubes) and/or advanced tubestock is the most reliable method of establishing woody native plants (trees, shrubs), and is also useful in establishing most of the native tussock grasses (e.g. *Themeda australis*, *Echinopogon* spp, *Poa* spp.).

Bushland restoration in degraded areas, in bare sites or in large clearings (>10 sq metres) will generally rely on the placement of tubestock, wherever possible supplemented by other methods of revegetation. Other methods that can be used include hand broadcasting of seed, brush layering and transplanting seedlings and or leaf litter from nearby bushland areas. Such supplementary methods may also be used to 'fill in the gaps' between planted tubestock.

In the Subject Property at Wahroonga

The planting of forestry tubes or advanced tubestock is strongly recommended, as these will establish rapidly with minimal care. The use of tubestock is also more economical, especially if large numbers of plants are required.

Larger or advanced stock (8" or 12" pots) may be used for specimen trees or shrubs in order to create an 'instant effect'. However, this approach is best reserved for landscaped areas or highly visible edge sites or buffers, and should not used where natural bush is being encouraged to regenerate naturally.

Hand Sowing

Seed of hardy pioneer species such as Wattles Acacia spp. and Sarsaparilla *Hardenbergia violacea* may be collected from local bushland and scattered on bare (prepared) soil between tubestock plantings[28]. As hand sowing (or direct seeding) is wasteful of seed, seed collected from most other species should be propagated as tubestock.

However, if a good source of native grass seed is available, hand sowing between tubestock planting may also be used. Grasses such as Hedgehog Grass *Echinopogon ovatus*, Bordered Panic *Entolasia marginate* and Weeping Meadow Grass *Microlaena stipoides*, and in wetter sites some of the local Juncaceae and Cyperaceae may also be suitable for hand sowing.

Grasses with more precise germination requirements such as Kangaroo Grass *Themeda australis* are best established via tubestock or transplanting divots from existing local stands.

Brush Layering (Brush Matting)

The use of mulched timber as a soil cover and to provide microhabitat is a cheap and effective way of re-establishing vegetation. If a source of local brush is available, it is strongly recommended that brush layering be used (possibly in addition to tubestock planting) as it provides a large amount of seed very cheaply and the brush itself provides extra protection for the new seedlings.

[28] Acacia seed must be treated prior to sowing. ~50% of the seed should be treated by pouring boiling water over it. Seeds should be soaked for 1-2 minutes, drained and allowed to dry.

If brush layering is used, then plants must bear ripe fruit/cones, and the branches must be cut and spread over bare (prepared) soil before the seed drops. The stress of cutting will release seed, so that cut brush cannot be stored for long periods of time. Brush is best used on the day it is cut. Alternatively, brush may be placed on a large canvas or plastic sheet so that any seed dropped is caught on the fabric.

However, the potential to use brush layering in the BGHF community is strictly limited because few appropriate species occur naturally (other than the Forest Oak *Allocasuarina torulosa* or possibly Muttonwood *Rapanea variabilis*).

In the Subject Property at Wahroonga

Tubestock planting will the primary strategy used to enhance species diversity in MZ 1 and 2 and reconstruct BGHF Habitat in MZs 3, 4 and 5.

Scattering native seed (primarily grasses and other ground covers) may also be used if seed with known provenance is commercially available or if seed can be sourced locally. Brush matting will not be applicable to this project as there are few species with the appropriate fruit / seed capsules in this type of vegetation community.

8.6 WORKS PROGRAM

8.6.1 Licences and Permits Required

The undertaking of on-ground works within an endangered ecological community (weed control, seed collection, planting or other works) requires the issuing of a Section 91 licence from the Licensing Unit of the NSW Department of Environment and Climate Change ('**DECC**'). Section 91 licenses are site-specific, so that such a license must be obtained prior to commencing work in any of the BGHF Habitat areas identified in this VMP.

Research or related studies which may impact in some way on a threatened species, population or ecological community (*TSC Act*), or on any protected species listed under the *National Parks & Wildlife Act (1974)* may only be carried out by a suitably qualified person holding a current Section 132C Scientific Licence from DECC. The obtaining of a Scientific Licence is the responsibility of responsibility of the individual worker/contractor.

Workers seeking to trap, capture or collect native fauna are also required to obtain an Ethics Licence from the NSW Department of Primary Industries.

8.6.2 Implementation and Timing of Works

The long-term nature of a bush regeneration project is strongly emphasised. Priority actions set out in the Plan have been limited to a 10-year timeframe, with a recommendation for review (and adjustment) after five (5) years. However, after this period of time the bushland should continue to be managed in accordance with the principles and guidelines set out in this VMP – this is, in perpetuity.

Timing of on-ground works are summarised in Figure 8.2. This provides an indication of both the duration and the chronology of each item listed within the initial 10 year program.

Note: Figure 8.2 provides no firm commencement or completion date for the Proposal.

8.6.3 Site Maintenance

A regular maintenance program will be required for all planted areas after the completion of initial works (site preparation and planting).

Actions embedded within the maintenance program are:

- Regular weeding to remove competitive exotic plant species and control invasive natives;
- Care of planted areas (including watering, disease control, application of native plant fertilisers and replacement of lost or failed plants);
- Maintenance of plant bags and stakes (with removal once plants overtop the bags); and
- Rubbish removal and care of edges and buffer zones.

Monitoring, evaluation and reporting are integral parts of the site maintenance program (see Section 8.8 and Appendix 7.

8.7 LABOUR AND RESOURCES

8.7.1 Contractors

Only trained bush regenerators should be used to work in environmentally sensitive areas where threatened species or remnant native vegetation could be harmed[29]. A trained bush regenerator is one who has successfully completed the accredited Bushland Weed Control Certificate course offered by NSW TAFE (or interstate equivalent) *and* who has completed at least 350 hours under supervision in the field[30]. Long-term bush regeneration programs are usually carried out on a yearly contract basis. There are several dozen professional contractors operating in the Sydney area alone

However, community volunteers are playing an increasingly important role in bushland management, and many councils and government agencies successfully use a combined contractor/volunteer approach to bush regeneration. The joint effort undertaken by these groups have frequently achieved dramatic results within a relatively short time. There is some potential in the future to involve some long-term patients and staff at *Waterbrook @ Wahroonga* in the bushland management program. Assistance in training and supervision are understood to be available free of charge through Council's Bushcare Unit.

If a Bushcare group is eventually recruited, or if permanent contract gardeners are employed by *Waterbrook*, using a professional bush regeneration supervisor to train and co-ordinate the work of

[29] Note licensing requirements require suitable qualifications, as detailed in Section 6.6.1

[30] Note that membership of a particular special interest group or organisation does not necessarily mean that its members are appropriately qualified.

volunteers and employed grounds staff improves the quality of work, and allows the job to move forward far more quickly than would be the case if only untrained or unskilled workers are used.

8.7.2 On-Site Supervision

The appointment of a qualified supervising Project Manager with experience in rehabilitating native landscapes (i.e. a Restoration Ecologist) is strongly recommended. The Project Manager will be the first point of contact for all stakeholders with respect to bushland issues.

The Project Manager will be responsible for implementation of each element of the VMP, for the review and assessment of methods and techniques employed, and will be responsible for 'sign off' at each stage (milestone) of the project. Note that it will be especially important that initial weed clearance is carefully supervised by the Project Manager (especially if and when machinery is used).

8.8 MONITORING AND ASSESSMENT

A simple monitoring program is recommended to assess the success of the bushland restoration program. The Project Manager and/or the bush regeneration contractor employed to carry out on-ground works should undertake monitoring.

Monitoring should continue for a period *at least* equal to the current bush regeneration program (i.e. 10 years). However, if usable, reliable quantitative data is to be gained from the monitoring program, it should continue indefinitely. Possibly, after set-up and trialling, the monitoring program can be taken up as an on-going project for environmental management students at a local university or TAFE college.

Monitoring procedures should be simple and straightforward, as well as inexpensive to implement. Monitoring should provide both qualitative (visual/photographs) and quantitative (statistical/quadrats) assessment. Reports should provide findings in a manner that is readily interpreted by all stakeholders.

Monitoring procedures, frequency and duration of survey, and reporting format should be agreed between the contractor and the client at the outset of the restoration project. Should the rehabilitation project itself extend beyond the 10-year lifetime of the VMP, procedures should be reviewed and updated as required.

Assessments should preferably be quantitative in nature (although photo-points will also form part of the monitoring process) and these must be measured against the Performance Indicators set out in Section 8.9.

Should monitoring and review indicate that the performance measures are not being met in a timely fashion, the strategies set out in the VMP should be reviewed, and the strategies set out in the Plan amended as necessary.

A generic guide to monitoring progress in bushland restoration projects has been included as Appendix 7.

8.9 PERFORMANCE INDICATORS

Performance Indicators are used to demonstrate that the program of implementation for the strategies outlined has been achieved.

The VMP has as its primary goals, the enhancement of species diversity, retention of canopy trees, and the creation of areas of BGHF Habitat for native flora and fauna.

Site-specific (or Zone focused) indicators should be set out in a detailed 'works plan' or 'action plan, prepared at tender contracting stage. The site works plan will set out individual tasks/area or site, provide a timetable of works over a designated period, and identify final costs.

The bush regeneration contractor, in consultation with the client, will prepare the works plan, which will include a basic monitoring program. In the meantime, the following Performance Indicators have been developed to serve as a general guide to monitoring the progress of the bushland rehabilitation program.

1. An increase in the cover/abundance of indigenous vegetation in each Management Zone (quantified via quadrat sampling –see Appendix 7).
2. An increase in floristic diversity in the BGHF Habitat areas overall, measured by quadrat sampling.
3. No net loss of indigenous plant species recorded in each Management Zone, measured by quadrat sampling (particularly of ground cover species).
4. Natural regeneration of seedlings of each indigenous plant species recorded in each Management Zone.
5. No net loss of threatened, vulnerable or other significant flora species recorded in the Subject Property (overall) and specifically in the BGHF Habitat areas.
6. Flowering and fruiting of each indigenous plant species recorded in each Management Zone and quadrat.
7. Increase in the diversity of habitat types and niches available for native fauna (qualitative assessment suitable).
8. Floristic and structural diversity maintained in each habitat type.
9. Increase in the number of native fauna species recorded or observed within BGHF Habitat areas and in the Subject Property overall (optimum levels to be determined).
10. Increase in the number of small passerine birds utilising the restored native shrub stratum (measured via consecutive biennial fauna surveys).
11. A decrease in the number of contractor/maintenance staff hours performing follow-up weed control and maintenance activities in each Management Zone (minimum level to be determined) over time.

12. A decrease in the effect of each negative impact or threatening process (e.g. weed invasion and unwanted growth of vegetation, soil erosion etc) recorded within the Subject Property overall (optimum levels to be determined).

Figure 8.1: Indicative Timetable of Works

ITEM / TASK	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		YEAR 7		YEAR 8		YEAR 9		YEAR 10	
PLANNING & ADMINISTRATION																				
VMP Approved by the NSW Department of Planning & Adopted by Waterbrook																				
Resources Allocated for 10-year Program																				
Liaison with Neighbours and (potential) Steering Committee established																				
Co-ordinate BGHF Rehabilitation, Construction & Landscaping Programs		a/r																		
Appoint a Project Manager to Oversee On-ground Works Programs																				
Call for tenders: Appoint Bush Regeneration Contractor																				
Determine Planting Needs & Organise for Indigenous Seed Collection & Propagation of Tubestock (12-18 months lead time –staggered delivery as required)																				

ITEM / TASK	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		YEAR 7		YEAR 8		YEAR 9		YEAR 10	
BLUE GUM HIGH FOREST HABITAT REHABILITATION PROGRAM (M ZONE 1 & 2)																				
Identify Significant Plantings to be Retained, Tag and Protect (as required)																				
Primary Weeding																				
Secondary/Follow-up Weeding (progressive) * *dependent on site response*																				
Maintenance Weeding																				
Enrichment Planting **dependent on natural regeneration*										a/r		a/r								
Plant Maintenance Program (weeding/watering etc)																				
BLUE GUM HIGH FOREST HABITAT RECONSTRUCTION PROGRAM (M ZONES 3 & 4 & 5)																				
Identify Significant Plantings to be Retained, Tag and Protect (as required)																				
Clearing of Existing Vegetation/Primary Weeding																				
Follow-up & Secondary Weeding * *dependent on site response*																				

ITEM / TASK	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		YEAR 6		YEAR 7		YEAR 8		YEAR 9		YEAR 10	
Maintenance Weeding																				
Indigenous Planting Program																				
Preparing Concept Planting Plan (species, densities & placement to be predetermined)																				
Site Preparation (earthworks/levels/drainage, soil remediation i/r, ripping)																				
Planting Tubestock with Planting Aids (a/r)												a/r								
Plant Maintenance (care of plants, watering, weeding, replacement planting)																				
OTHER																				
Monitoring Program & Annual Reporting																				
Review of POM & Revision/Extension of Program (a/r)																				

Note: each year is divided into 6-monthly increments.

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10 APPENDICES

Appendix 1: Final Determination – Blue Gum High Forest

Blue Gum High Forest in the Sydney Basin Bioregion - critically endangered ecological community listing

NSW Scientific Committee - final determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list the Blue Gum High Forest in the Sydney Basin Bioregion, as a critically endangered ecological community in Part 2 of Schedule 1A of the Act, and as a consequence omit reference to the Blue Gum High Forest in Part 3 of Schedule 1 of the Act. Listing of critically endangered ecological communities is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. Blue Gum High Forest in the Sydney Basin Bioregion is the name given to the ecological community characterised by the species assemblage listed in paragraph 2. All sites are within the Sydney Basin Bioregion.

2. Blue Gum High Forest in the Sydney Basin Bioregion is characterised by the following assemblage of species:

Acmena smithii	*Adiantum aethiopicum*
Allocasuarina torulosa	*Alphitonia excelsa*
Angophora costata	*Angophora floribunda*
Asplenium flabellifolium	*Backhousia myrtifolia*
Blechnum cartilagineum	*Breynia oblongifolia*
Calochlaena dubia	*Carex maculata*
Cissus hypoglauca	*Clematis aristata*
Clerodendrum tomentosum	*Dianella caerulea*
Doodia aspera	*Elaeocarpus reticulatus*
Entolasia marginata	*Entolasia stricta*
Eucalyptus globoidea	*Eucalyptus paniculata*
Eucalyptus pilularis	*Eucalyptus saligna*
Eustrephus latifolius	*Ficus coronata*
Glochidion ferdinandi var. *ferdinandi*	*Glycine clandestina*
Hydrocotyle laxiflora	*Leucopogon juniperinus*
Lomandra longifolia	*Marsdenia rostrata*
Maytenus silvestris	*Morinda jasminoides*
Notelaea longifolia forma *longifolia*	*Oplismenus aemulus*
Oplismenus imbecillis	*Oxalis perennans*
Pandorea pandorana	*Persoonia linearis*
Pittosporum revolutum	*Pittosporum undulatum*

Platylobium formosum	*Poa affinis*
Polyscias sambucifolia subsp. A	*Pratia purpurascens*
Pseuderanthemum variabile	*Pteridium esculentum*
Rapanea variabilis	*Smilax australis*
Smilax glyciphylla	*Tylophora barbata*
Viola hederacea	

3. The total species list of the community is considerably larger than that given above, with many species present in only one or two sites or in low abundance. The species composition of a site will be influenced by the size of the site, recent rainfall or drought condition and by its disturbance (including fire) history. The number of species, and the above ground relative abundance of species will change with time since fire, and may also change in response to changes in fire regime (including changes in fire frequency). At any one time, above ground individuals of some species may be absent, but the species may be represented below ground in the soil seed banks or as dormant structures such as bulbs, corms, rhizomes, rootstocks or lignotubers. The list of species given above is of vascular plant species; the community also includes micro-organisms, fungi, cryptogamic plants and a diverse fauna, both vertebrate and invertebrate. These components of the community are poorly documented.

4. Blue Gum High Forest is dominated by a tall canopy of eucalypts that may exceed 30 m in height. Its understorey is typically multi-layered with a midstorey of mesophyllous shrubs and small trees and a diverse ground layer of herbs, ferns and some grasses. Most stands of the community are in a state of regrowth after past clearing or logging activities, and consequently trees may be shorter, less dense or more dense than less disturbed stands. Blue Gum High Forest is dominated by either *Eucalyptus pilularis* (Blackbutt) or *E. saligna* (Sydney Blue Gum). *Angophora costata* (Smooth-barked Apple) is frequently observed in remnants close to the shale/sandstone boundary, but also occurs infrequently on deep shale soils, as does *A. floribunda* (Rough-barked Apple). *Eucalyptus paniculata* (Grey Ironbark) is typically found on upper slopes. A relatively diverse stratum of small trees is usually present, and includes *Pittosporum undulatum* (Sweet Pittosporum), *Elaeocarpus reticulatus* (Blueberry Ash) and *Allocasuarina torulosa* (Forest Oak). Shrub species are typically mesophyllous, such as *Breynia oblongifolia* (Coffee Bush), *Pittosporum revolutum,* (Yellow Pittosporum), *Clerodendrum tomentosum, Notelaea longifolia* forma *longifolia* (Large Mock-olive), *Maytenus sylvestris* (Narrow-leaved Orange Bark), *Polyscias sambucifolia* subsp. A (Elderberry Panax) and *Rapanea variabilis* (Muttonwood).

Mesophyllous species are generally more common in gullies associated with both shale and volcanic soils than slopes and ridgetops. Sclerophyllous species such as *Persoonia linearis* (Narrow-leaved Geebung) and *Leucopogon juniperinum* (Prickly Bearded-heath) occur more frequently closer to the shale/sandstone boundary. The ground stratum is often dense and contains a mixture of herb, grass and fern species including *Adiantum aethiopicum, Entolasia marginata* (Bordered Panic), *Lomandra longifolia* (Spiny-headed Matrush), *Calochlaena dubia* (Common Groundfern), *Dianella caerulea* (Blue Flax Lily), *Pseuderanthemum variabile* (Pastel Flower) and *Oplismenus imbecillis*. Vine species are also frequently present, in particular *Tylophora barbata* (Bearded Tylophora), *Eustrephus latifolia,* (Wombat Berry), *Clematis aristata* (Old Man's Beard) and *Pandorea pandorana* (Wonga

Wonga Vine).

5. While no systematic fauna surveys have been carried out across the range of Blue Gum High Forest a number of mammal and bird species listed as threatened in NSW have been recorded as resident or transient in the community. These include the Grey-headed Flying Fox (*Pteropus poliocephalus*), Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventri*s), Glossy Black cockatoo (*Calyptorhynchus lathami*) and the Powerful Owl (*Ninox strenua*).

6. Blue Gum High Forest is typically associated with soils derived from Wianamatta Shale (Tozer 2003), though may occur in adjacent areas underlain by Hawkesbury Sandstone. The community also occurs on soils associated with localised volcanic intrusions, 'diatremes' (Benson and Howell 1994). Typically, Blue Gum High Forest occurs more than 100m above sea level, where rainfall exceeds 1050 mm per annum, although it may be present in sheltered locations with lower rainfall (Tozer 2003). In drier areas and approaching the shale/sandstone boundary, it intergrades with Sydney Turpentine Ironbark Forest, which is currently listed as an Endangered Ecological Community under the TSC Act. Stands that exhibit intermediate characteristics are collectively covered by the Determinations of these communities and may be diagnosed by detailed consideration of the assemblage of species present at the site.

7. Vegetation surveys carried out across the range of Blue Gum High Forest include those of Benson and Howell (1990, 1994) and Tozer (2003). All of these studies describe and map this community as 'Blue Gum High Forest', including map unit 6b 'Tall open-forest: *Eucalyptus pilularis – Eucalyptus saligna*' of Benson and Howell (1994) and map unit 153 of Tozer (2003). In addition, Benson and Howell (1994) map separately that part of this community which occurs on soils associated with diatremes as 'Glen Forest, map unit 6c, i. Tall open-forest: *Eucalyptus saligna*', noting that this vegetation was 'very similar to the Blue Gum High Forest of the north shore [i. e. map unit 6b]'. Blue Gum High Forest belongs to the North Coast Wet Sclerophyll Forests vegetation class of Keith (2004).

8. Blue Gum High Forest is found on the north shore and northern suburbs of Sydney and has been recorded from the local government areas of Lane Cove, Willoughby, Ku-ring-gai, Hornsby, Baulkham Hills, Ryde and Parramatta within the Sydney Basin Bioregion and may occur elsewhere in the Bioregion.

9. Blue Gum High Forest has a very highly restricted geographic distribution, and is currently estimated to cover an extant area of less than 200 ha (Tozer 2003). The distribution comprises a series of small remnant patches, the largest of which is less than 20ha. Highly modified relics of the community also persist as small clumps of trees without a native understorey. All remnants of the community are now surrounded by urban development. Consequently, the distribution of Blue Gum High Forest is severely fragmented. Fragmentation of habitat contributes to a very large reduction in the ecological function of the community.

10. Prior to European settlement, about 200 years ago, Blue Gum High Forest is estimated to have covered an area of approximately 3700 ha (Tozer 2003). Its current extent amounts to less than 5% of this original distribution. The dominant eucalypts of the community live for several hundred years.

Blue Gum High Forest has therefore undergone a very large reduction in its geographic distribution within a time span appropriate to the life cycle and habitat characteristics of its component species. Small-scale clearing associated with residential subdivision, road upgrading, extension and maintenance of service easements, etc. pose a threat of ongoing decline in the extent of the community. Clearing of native vegetation is listed as a Key Threatening Process under the Threatened Species Conservation Act 1995.

11. Changes in structure of Blue Gum High Forest have occurred as a consequence of the extensive removal of large old trees. A number of stands of Blue Gum Forests have highly modified understories, in which the native woody component has been largely replaced by woody exotic species or by increased abundance of native and exotic grasses. Continued underscrubbing, frequent burning and mowing may maintain the understorey in an artificially open state and prevent recruitment of species with the community. The loss of large trees removes essential habitat for a range of tree-dependent fauna (Gibbons and Lindenmeyer 1996). The reduction of understorey complexity, through the reduction of native shrub cover, degrades habitat for a range of bird and mammal species (Catling 1991). These processes contribute to a very large reduction in the ecological function of the community.

12. The influx of stormwater, which brings excessive moisture, pollutants and nutrients to the remnant forests from surrounding urban areas, is a significant ongoing threat to the ecological integrity of Blue Gum High Forest. This, together with the legacy of past disturbances and the abundance and dispersal of weed propagules from nearby urban areas, results in the invasion, establishment and spread of weeds (Thomson and Leishman 2005). Problematic weed species in Blue Gum High Forest include the following:

Asparagus asparagoides	Bridal Creeper
Cinnamomum camphora	Camphor laurel
Lantana camara	Lantana
Ligustrum lucidum	Large-leaved Privet
Ligustrum sinense	Small-leaved Privet
Ochna serrulata	
Passiflora edulis	Passionfruit
Passiflora subpeltata	Passionfruit
Pennisetum clandestunum	Kikuyu
Rubus ulmifolius	Blackberry
Senna colutioides (=Cassia)	

Tradescantia fluminensis	

'Invasion and establishment of exotic vines and scramblers', 'Invasion of native plant communities by exotic perennial grasses' and 'Invasion, establishment and spread of Lantana (*Lantana camara* L. *sens. lat*)' are listed as Key Threatening Processes under the Threatened Species Conservation Act. The influx of stormwater, pollutants and nutrients, and the invasion of weeds contribute to a very large reduction in the ecological function of the community.

13. Blue Gum High Forest in the Sydney Basin Bioregion is eligible to be listed as a critically endangered ecological community as, in the opinion of the Scientific Committee, it is facing an extremely high risk of extinction in New South Wales in the immediate future, as determined in accordance with the following criteria as prescribed by the Threatened Species Conservation Regulation 2002:

Clause 25

The ecological community has undergone, is observed, estimated, inferred or reasonably suspected to have undergone, or is likely to undergo within a time span appropriate to the life cycle and habitat characteristics of its component species:

(a) a very large reduction in geographic distribution.

Clause 26

The ecological community's geographic distribution is estimated or inferred to be:
(b) very highly restricted, and the nature of its distribution makes it likely that the action of a threatening process could cause it to decline or degrade in extent or ecological function over a time span appropriate to the life cycle and habitat characteristics of the ecological community's component species.

Clause 27

The ecological community has undergone, is observed, estimated, inferred or reasonably suspected to have undergone, or is likely to undergo within a time span appropriate to the life cycle and habitat characteristics of its component species:
(a) a very large reduction in ecological function,
as indicated by any of the following:
(b) change in community structure
(c) change in species composition
(f) disruption of ecological processes
(g) invasion and establishment of exotic species
(h) degradation of habitat
(i) fragmentation of habitat

Associate Professor Lesley Hughes

Chairperson
Scientific Committee
Proposed Gazettal date: 20/04/07
Exhibition period: 20/04/07 – 15/06/07

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Appendix 2: List of Flora Species Recorded at the Former John Williams Childrens Convalesent, Wahroonga[31]

KEY

■ - Species of National or State conservation significance.

* - Introduced or non-indigenous native species.

?* – Species suspected of being planted

Note that due to the large amount of generally 'native' planting undertaken in the Subject Property, it is often difficult to distinguish what is naturally occurring and what has been planted. Many species not marked with a * may be naturally occurring and/or they may have been planted.

Species Frequency of Occurrence within the Site

V - Very common (species covers 51-100% of the site).

C - Common (species covers 26-50% of the site).

O - Occasional (species covers 5-25% of the site).

R - Rare (species covers <5% of the site; scattered distribution).

L - Localised distribution only (species covers <5% of the site; clumped distribution).

FAMILY	SPECIES	COMMON NAME	FREQUENCY
FILICOPSIDA			
Adiantaceae	*Adiantum aethiopicum*	Maidenhair Fern	**R**
Aspleniaceae	*Asplenium australasicum**	Birds Nest Fern	**R**
Blechnaceae	*Blechnum ambiguum*	Gristle Fern	**L**
Cyatheaceae	*Cyathea australis**	Rough Tree Fern	**R**
Cyatheaceae	*Cyathea cooperi**	Scaly Tree Fern	**R**
Davalliaceae	*Nephrolepis cordifolia**	Fishbone Fern	**O**
Dicksoniaceae	*Calochlaena dubia*	False Bracken Fern	**R**
CONIFEROPSIDA			
Araucariaceae	*Araucaria bidwillii**	Bunya Bunya Pine	**R**
Araucariaceae	*Araucaria cunninghamii**	Hoop Pine	**R**
Araucariaceae	*Araucaria heterophylla**	Norfolk Island Palm	**R**
Cupressaceae	*Cupressus* sp.*	Cypress	**R**
Pinaceae	*Callistris ? rhomboidea**	Port Jackson Pine	**R**
Pinaceae	*Cedrus deodora**	Deodar	**R**
Pinaceae	*Pinus radiata**	Monterey Pine	**R**
DICOTYLEDONS			
Acanthaceae	*Drejerella guttata**	Shrimp Plant	**R**
Acanthaceae	*Pseuderanthemum variabile*	Pastel Flower	**R**
Acanthaceae	*Strobilanthes isophyllus**	Golfussia	**R**

[31] Recorded by UBMC July 2006, but occurrence of species updated October 2008 but frequency not recorded

FAMILY	SPECIES	COMMON NAME	FREQUENCY
Acanthaceae	*Thunbergia alata**	Black-eyed Susan	**L**
Aceraceae	*Acer negundo**	Box Elder Maple	**R**
Aceraceae	*Acer palmatum**	Japanese Maple	**R**
Amaranthaceae	*Alternanthera denticulata*	Lesser Joyweed	**R**
Anacardiaceae	*Harpephylum caffrum**	Kaffir Plum	**R**
Apiaceae	*Centella asiatica*	Kidney Weed	**R**
Apiaceae	*Ciclospermum leptophyllum**	Slender Celery	**R**
Apocynaceae	*Nerium oleander**	Oleander	**R**
Apocynaceae	*Parsonsia straminea*	Common Silkpod	**R**
Araceae	*Monstera deliciosa**	Monstera	**R**
Araceae	*Philodendron* sp.*	Philodendron	**R**
Araliaceae	*Hedera helix**	English Ivy	**R**
Araliaceae	*Polyscias elegans*	Celery Wood	**R**
Araliaceae	*Schefflera* sp.*	Umbrella Tree	**R**
Asclepiadaceae	*Araujia sericifera**	White Moth Vine	**R**
Asteraceae	*Ageratina adenophora**	Crofton Weed	**L**
Asteraceae	*Ageratina riparia**	Mistflower	**L**
Asteraceae	*Bidens pilosa**	Cobbler's Pegs	**R**
Asteraceae	*Cirsium vulgare**	Spear Thistle	**R**
Asteraceae	*Conyza* sp.*	Fleabane	**R**
Asteraceae	*Dimorphotheca ecklonis**	Star of the Veldt	**R**
Asteraceae	*Erigeron karvinskianus**	Fleabane	**L**
Asteraceae	*Hypochaeris radicata**	Catsear	**R**
Asteraceae	*Osteospermum ecklonis**	Daisy	**R**
Asteraceae	*Senecio hispidulus* var. *hispidulus*	Hill Fireweed	**R**
Asteraceae	*Senecio madagascariensis**	Fireweed	**R**
Asteraceae	*Senecio* sp.*		**R**
Asteraceae	*Sonchus oleraceus**	Common Sow Thistle	**R**
Asteraceae	*Taraxacum officinale**	Dandelion	**R**
Balsaminaceae	*Impatiens* sp.*	Impatiens	**L**
Bassellacea	*Anredera cordifolia**	Madeira Vine	**R**
Begoniaceae	*Begonia* sp.*	Begonia	**R**
Berberidaceae	*Nandina domestica**	Sacred Bamboo	**L**

FAMILY	SPECIES	COMMON NAME	FREQUENCY
Bignoniaceae	*Jacaranda mimosifolia**	Jacaranda	**R**
Caprifoliaceae	*Abelia ? grandiflora.**	Abelia	**R**
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle	**O**
Casuarinaceae	*Allocasuarina distyla ?**	Forest Oak	**R**
Casuarinaceae	*Allocasuarina glauca**	Swamp Oak	**R**
Convolvulaceae	*Dichondra repens*	Kidney Weed	**O**
Convolvulaceae	*Ipomea indica**	Morning Glory	**O**
Crassulaceae	*Sedum* sp.*	Sedum	**L**
Crassulaceae	*Saxifraga umbrosa**	Pride of London	**R**
Cucurbitaceae	*Cucurbita maxima**	Pumpkin	**L**
Cunoniaceae	*Ceratopetalum apetalum*	Coachwood	**R**
Cunoniaceae	*Ceratopetalum gummiferum**	Christmas Bush	**R**
Elaeocarpaceae	*Elaeocarpus reticulatus**	Blueberry Ash	**R**
Elaeaganaceae	*Elaeagans pungens* 'maculata'*	Oleaster	**R**
Epacridaceae	*Leucopogon juniperinus*	Bearded Heath	**R**
Ericaceae	*Arbutus unedo**	Strawberry Tree	**R**
Ericaceae	*Azalea* spp.*	Azalea	**R**
Ericaceae	*Rhododendron* spp.*	Rhododendron	**R**
Euphorbiaceae	*Euphorbia peplus**	Petty Spurge	**R**
Euphorbiaceae	*Omalanthus populifolius*	Bleeding Heart	**R**
Fabaceae: Caesalpiniaceae	*Bauhinia* sp.*	Bauhinia	**R**
Fabaceae: Caesalpiniaceae	*Senna pendula**	Senna	**R**
Fabaceae: Faboideae	*Erythrina sykesii**	Coral Tree	**R**
Fabaceae: Faboideae	*Genista monspessulana**	Montpellier Broom	**O**
Fabaceae: Faboideae	*Glycine clandestina*	Love Creeper	**R**
Fabaceae: Faboideae	*Kennedia rubicunda*	Dusky Coral Pea	**R**
Fabaceae: Faboideae	*Wisteria floribunda **	Wisteria	**R**
Fabaceae: Mimosoideae	*Acacia baileyana**	Cootamundra Wattle	**R**
Fabaceae: Mimosoideae	*Acacia decurrens**	Green Wattle	**R**
Fabaceae: Mimosoideae	*Acacia elata**	Cedar Wattle	**R**
Fabaceae: Mimosoideae	*Acacia fimbriata*	Fringed Wattle	**R**
Fabaceae: Mimosoideae	*Acacia longifolia* var. *longifolia*	Sydney Golden Wattle	**R**
Gentianaceae	*Centaurium erythraea**	Common Centaury	**R**
Geraniaceae	*Geranium homeanum*	Cranesbill	**R**

FAMILY	SPECIES	COMMON NAME	FREQUENCY
Hamamelidaceae	*Liquidambar* sp.*	Liquidambar	**R**
Labiateae	*Westringia* x Hybrid*	Blue Westringia	**R**
Labiateae	*Salvia* sp.*	Salvia	**R**
Lamiaceae	*Lavandula* sp.*	Lavender	**R**
Lauraceae	*Cinnamomum camphora**	Camphor Laurel	**R**
Lobeliaceae	*Pratia purpurascens*	White Root	**R**
Loganiaceae	*Gelsemium sempervirens**	Gelsemium	**L**
Loganiaceae	*Buddleia ? davidii**	Butterfly Bush	**R**
Lythraceae	*Lagerstroemia indica**	Crepe Myrtle	**L**
Magnoliaceae	*Magnolia grandiflora **	Bull Magnolia	**R**
Malaceae	*Photinia* sp.*	Photinia	**R**
Malvaceae	*Hibiscus* sp.*	Hibiscus	**R**
Malvaceae	*Malvaviscus arboreus**	Turks Cap	**R**
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow	**R**
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne	**R**
Melastomataceae	*Tibouchina* sp.*	Tibouchina	**R**
Meliaceae	*Melia azedarach*	White Cedar	**R**
Meliaceae	*Toona australis**	Red Cedar	**R**
Moraceae	*Ficus carica**	Fig	**R**
Moraceae	*Ficus pumila**	Creeping Fig	**R**
Moraceae	*Ficus rubiginosa ?**	Port Jackson Fig	**R**
Moraceae	*Morus alba**	White Mulberry	**R**
Myrsinaceae	*Ardisia crenata**	Coral Berry	**R**
Myrtaceae	*Acmena smithii**	Lilly Pilly	**R**
Myrtaceae	*Angophora floribunda*	Rough-barked Apple	**R**
Myrtaceae	*Callistemon salignus*	Willow Bottlebrush	**R**
Myrtaceae	*Callistemon* sp.*	Bottlebrush	**R**
Myrtaceae	*Corymbia citriodora**	Lemon Scented Gum	**R**
Myrtaceae	*Corymbia maculata**	Spotted Gum	**R**
Myrtaceae	*Eucalyptus paniculata*	Grey Ironbark	**R**
Myrtaceae	*Eucalyptus pilularis*	Blackbutt	**R**
Myrtaceae	*Eucalyptus saligna*	Sydney Blue Gum	**O**
Myrtaceae	*Kunzea ambigua**	White Tick Bush	**R**
Myrtaceae	*Lophostemon confertus**	Brush Box	**R**

FAMILY	SPECIES	COMMON NAME	FREQUENCY
Myrtaceae	*Syncarpia glomulifera*	Turpentine	**R**
Myrtaceae	■ *Syzygium paniculatum ?**	Magenta Lilly Pilly	**R**
Myrtaceae	*Tristaniopsis laurina**	Water Gum	**R**
Myrtaceae	*Waterhousea floribunda**	Weeping Myrtle	**R**
Nyctaginaceae	*Mirabilis jalapa**	Marvel of Peru	**R**
Ochnaceae	*Ochna serrulata**	Ochna	**R**
Oleaceae	*Fraxinus* sp.*	Ash	**R**
Oleaceae	*Jasminum polyanthum**	Jasmine	**R**
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet	**O**
Oleaceae	*Ligustrum sinense**	Small-leaved Privet	**O**
Oleaceae	*Olea europaea* ssp. *cuspidata**	Olive	**R**
Oxalidaceae	*Oxalis pes-caprae**	Soursob	**R**
Oxalicaceae	*Oxalis* sp.*	Oxalis	**R**
Passifloraceae	*Passiflora edulis**	Passionfruit	**R**
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	**O**
Plantaginaceae	*Plantago lanceolata**	Plantain	**R**
Plumbaginaceae	*Plumbago auriculata**	Plumbago	**R**
Polygonaceae	*Persicaria capitata**	Japanese Knotweed	**L**
Polygonaceae	*Rumex* sp.*	Dock	**R**
Proteaceae	*Grevillea linearifolia ?**	White Spider Flower	**R**
Proteaceae	*Grevillea robusta**	Silky Oak	**R**
Proteaceae	*Grevillea* sp.*	Grevillea	**R**
Proteaceae	*Macadamia integrifolia**	Macadamia Nut	**R**
Ranunculaceae	*Clematis aristata*	Old Man's Beard	**R**
Ranunculaceae	*Ranunculus repens**	Creeping Buttercup	**R**
Rhamnaceae	*Pomaderris lanigera*	Woolly Pomaderris	**R**
Rosaceae	*Chaenomeles* x cultivar*	Flowering Quince	**R**
Rosaceae	*Cotoneaster glaucophyllus**	Cotoneaster	**R**
Rosaceae	*Duchesnea indica**	Indian Strawberry	**L**
Rosaceae	*Malus domesticus**	Apple Tree	**R**
Rosaceae	*Prunus persica var. persica**	Peach	**R**
Rosaceae	*Prunus* sp.*	Flowering Cherry	**R**
Rosaceae	*Pyracantha angustifolia**	Firethorn	**R**
Rosaceae	*Rhaphiolepis indica**	Indian Hawthorn	**R**

FAMILY	SPECIES	COMMON NAME	FREQUENCY
Rosaceae	*Rosa* sp.*	Rose	**R**
Rosaceae	*Rubus fruticosus**	Blackberry	**R**
Rubiaceae	*Gardenia angusta**	Gardenia	**R**
Rubiaceae	*Luculia* sp.*	Luculia	**R**
Rubiaceae	*Choisya ternata**	Mexican Orange Blossom	**R**
Rutaceae	*Acronychia oblongifolia*	Yellow Wood	**R**
Rutaceae	*Citrus* sp.*	Lemon Tree	**R**
Rutaceae	*Murraya paniculata**	Orange Jessamine	**R**
Saxifragaceae	*Escallonia* x hybrid*	Escallonia	**R**
Saxifragaceae	*Hydrangea macrophylla**	Hydrangea	**R**
Scrophulariaceae	*Hebe* sp.*	Veronica	**R**
Scrophulariaceae	*Russelia equisetiformis**	Fountain Flower	**R**
Scrophulariaceae	*Veronica persica**	Speedwell	**R**
Solanaceae	*Solanum mauritianum**	Wild Tobacco	**R**
Solanaceae	*Solanum nigrum**	Black Nightshade	**R**
Sterculiaceae	*Brachychiton acerifolius**	Flame Tree	**R**
Theaceae	*Camellia japonica**	Camellia	**R**
Theaceae	*Camellia sasanqua**	Camellia	**R**
Tropaeolaceae	*Tropaeolum majus**	Nasturtium	**R**
Ulmaceae	*Ulmus parviflora**	Chinese Elm	**R**
Urticaceae	*Parietaria judaica**	Sticky Weed	**R**
Valerianaceae	*Centranthus ruber**	Red Valerian	**R**
Verbenaceae	*Duranta repens**	Pigeonberry	**R**
Verbenaceae	*Verbena bonariensis**	Purple Top	**R**
Violaceae	*Viola odorata**	Sweet Violet	**L**
Vitaceae	*Vitis vinifera**	Grape	**R**
MONOCOTYLEDONS			
Agavaceae	*Cordyline ? terminalis**	Cordyline	**R**
Agavaceae	*Doryanthes excelsa**	Gymea Lily	**R**
Alliaceae	*Agapanthus africanus**	Agapanthus	**O**
Amaryllidaceae	*Clivia minuata**	Kaffir Lily	**L**
Amaryllidaceae	*Crinum pedunculatum**	Crinum Lily	**R**
Anthericaceae	*Chlorophytum comosum**	Spider Plant	**R**
Arecaceae	*Arecastrum romanzoffianum**	Queen Palm	**L**

FAMILY	SPECIES	COMMON NAME	FREQUENCY
Arecaceae	*Livistona australis ?**	Cabbage-tree Palm	**R**
Arecaceae	*Phoenix canariensis**	Canary Island Date Palm	**R**
Arecaceae	*Trachycarpus* sp.*	Windmill Palm	**R**
Arecaceae	*Washingtonia* sp.*	Fan Palm	**R**
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern	**O**
Asparagaceae	*Asparagus plumosus**	Climbing Asparagus	**L**
Asphodelaceae	*Aloe vera**	Aloe	**L**
Cannaceae	*Canna indica**	Canna / Yellow Shot	**L**
Commelinaceae	*Tradescantia fluminensis**	Wandering Jew	**R**
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge	**R**
Cyperaceae	*Cyperus gracilis*	Sedge	**R**
Cyperaceae	*Cyperus imbecillis*	Sedge	**R**
Iridaceae	*Crocosmia x crocosmiiflora**	Montbretia	**L**
Iridaceae	*Dietes vegeta**	Fortnight Lily	**L**
Iridaceae	*Freesia refracta**	Freesia	**L**
Iridaceae	*Iris* sp.*	Iris	**L**
Iridaceae	*Orthrosanthus multiflorus**		**R**
Liliaceae	*Begonia* sp *	Begonia	**R**
Liliaceae	*Lilium formosanum**	Tiger Lily	**R**
Liliaceae	*Ophiopogon japonicus**	Mondo Grass	**L**
Musaceae	*Musa paradisiaca**	Banana	**L**
Orchidaceae	*Epidendrum radicans**	Crucifix Orchard	**L**
Philesiaceae	*Eustrephus latifolius*	Wombat Berry	**R**
Phormiaceae	*Dianella longifolia*	Blue Flax Lily	**R**
Poaceae	*Axonopus affinis**	Carpet Grass	**R**
Poaceae	*Briza maxima**	Quaking Grass	**R**
Poaceae	*Bromus catharticus**	Prairie Grass	**R**
Poaceae	*Cynodon dactylon**	Couch	**O**
Poaceae	*Dactylis glomerata**	Cocksfoot	**R**
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass	**R**
Poaceae	*Ehrharta erecta**	Panic Veldt Grass	**O**
Poaceae	*Imperata cylindrica*	Blady Grass	**L**
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Meadow Grass	**O**

FAMILY	SPECIES	COMMON NAME	FREQUENCY
Poaceae	*Oplismenus imbecillis*	Basket Grass	**O**
Poaceae	*Paspalum dilatatum**	Paspalum	**O**
Poaceae	*Paspalum urvillei**	Vasey Grass	**R**
Poaceae	*Pennisetum clandestinum**	Kikuyu Grass	**R**
Poaceae	*Phyllostachys aurea**	Fishpole Bamboo	**L**
Poaceae	*Setaria gracilis**	Pigeon Grass	**R**
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass	**O**
Strelitziaceae	*Strelitzia nicolai**	Bird of Paradise	**R**
Strelitziaceae	*Strelitzia reginae**	Bird of Paradise	**R**
Zingiberaceae	*Hedychium gardnerianum**	Yellow Ginger	**L**

Appendix 3: Native Fauna Species Recorded Within the Subject Property

Source: UBMC 2006.

COMMON NAME	FAMILY AND SCIENTIFIC NAME
MAMMALS	
	Pseudocheiridae
Common Ringtail Possum	*Pseudocheirus peregrinus*
	Phalangeridae
Common Brushtail Possum	*Trichosurus vulpecula*
	Pteropodidae
Grey-headed Flying Fox	*Pteropus poliocephalus*
	Vespertilioidae
Gould's Wattled Bat	*Chalinolobus gouldii*
BIRDS	
	Cacatuidae
Gang-Gang Cockatoo	*Callocephalon fimbriatum*
Sulphur-crested Cockatoo	*Cacatua galerita*
	Psittacidae
Rainbow Lorikeet	*Trichoglossus haematodus*
Australian King Parrot	*Alisterus scapularis*
Eastern Rosella	*Platycercus eximius*
	Podargidae
Tawny Frogmouth	*Podargus strigoides*
	Alcedinidae
Laughing Kookaburra	*Dacelo naxaeguineae*
	Pardalotidae
Spotted Pardalote	*Pardalotus punctatus*
	Meliphagidae
Noisy Miner	*Manorina melanocephala*
	Campephagidae
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*
	Artamidae
Grey Butcherbird	*Cracticus torquatus*

COMMON NAME	FAMILY AND SCIENTIFIC NAME
Australian Magpie	*Gymnorhina tibicen*
Pied Currawong	*Strepera graculina*
	Corvidae
Australian Raven	*Corvus coronoides*
	Hirundinidae
Welcome Swallow	*Hirundo neoxena*
REPTILES	
	Scincidae
Grass Skink	*Lampropholis delicata*
Weasel Skink	*Saproscincus mustelinus*

Appendix 4: Results of the Weed Mapping Project (UBM October 2008)

The Results of the Weed Mapping (UBM October 2008) as carried out in each of the six (6) weed polygons surveyed are presented below.

Polygon A

Polygon A covers an area which still retains large BGHF canopy tree species. The understorey contains unmaintained garden beds and some lawn area, which is now heavily infested with weeds.

Table A shows the comparative results of the 2007 and 2008 weed surveys. Fourteen (14) new weed species were detected during the 2008 survey. Of these, one (a new occurrence) is listed as a Noxious Weed (Blackberry *Rubus fruticosus*), and four (4) are listed as Keystone Weeds (UBM 2007). The Keystone Weeds Morning Glory Vine *Ipomoea indica* and Montpellier Broom *Genista monspessulana* have increased in abundance.

Table A: Weed Species and Abundance for Polygon A (UBM October 2008)

KEY

New Keystone Weeds

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED		TYPE OF WEEDS		
			A (2007)	A	NOXIOUS & CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Fabaceae	*Acacia baileyana**	Cootamundra Wattle		**<25**			**x**
Aceraceae	*Acer negundo**	Box Elder Maple		**<25**		**x**	**x**
Alliaceae	*Agapanthus praecox**	Agapanthus		**50 - 75**			**x**
Asteraceae	*Ageratina adenophora**	Crofton Weed	**0**	**<25**			**x**
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern		**75-100**	**4**		**x**
Asparagaceae	*Asparagus plumosus**	Climbing Asparagus		**<25**	**4**		**x**
Ericaceae	*Azalea* spp.*	Azalea	**0**	**<25**			
Begoniaceae	*Begonia* sp.*	Begonia	**0**	**<25**			
Sterculiaceae	*Brachychiton acerifolius**	Flame Tree		**<25**			**x**
Poaceae	*Bromus catharticus**	Prairie Grass		**<25**			**x**
Pinaceae	*Cedrus deodora**	Deodar	**0**	**<25**			

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED		TYPE OF WEEDS		
			A (2007)	A	NOXIOUS & CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Ulmaceae	*Celtis occidentalis**	Hackberry		<25		x	x
Lauraceae	*Cinnamomum camphora**	Camphor Laurel		25-50	4		x
Asteraceae	*Conyza* sp.*	Fleabane	0	<25			x
Rosaceae	*Cotoneaster glaucophyllus**	Cotoneaster		<25		z	x
Iridaceae	*Crocosmia x crocosmiiflora**	Montbretia		25-50			x
Iridaceae	*Dietes vegeta**	Fortnight Lily / Peacock Iris		<25			x
Poaceae	*Ehrharta erecta**	Panic Veldt Grass	0	<25			x
Elaeocarpaceae	*Elaeocarpus reticulatus**	Blueberry Ash	0	<25			
Asteraceae	*Erigeron karvinskianus**	Fleabane	0	<25			
Asteraceae	*Euryops abrotanifolius**	Winter Euryops		<25			x
Fabaceae	*Genista monspessulana**	Montpellier Broom	<25	25-50	3		x
Araliaceae	*Hedera helix**	English Ivy		<25		x	x
Zingiberaceae	*Hedychium gardnerianum**	Yellow Ginger		<25			x
Balsaminaceae	*Impatiens* sp.*	Impatiens	0	<25			
Convolvulaceae	*Ipomoea indica**	Morning Glory	<25	25-50	4		x
Bignoniaceae	*Jacaranda mimosifolia**	Jacaranda	25-50	<25			x
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet		75-100			x
Oleaceae	*Ligustrum sinense**	Small-leaved Privet		<25	4		x
Liliaceae	*Lilium formosanum**	Tiger Lily		<25			x
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle		25-50			x

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED		TYPE OF WEEDS		
			A (2007)	A	NOXIOUS & CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Araceae	*Monstera deliciosa**	Monstera		**<25**			**x**
Boraginaceae	*Myosotis discolor*	Forget-me-not	**0**	**<25**			
Apocynaceae	*Nerium oleander**	Oleander		**<25**			**x**
Ochnaceae	*Ochna serrulata**	Ochna		**<25**	**4**		**x**
Oleaceae	*Olea europaea* ssp. *cuspidata**	African Olive		**<25**			**x**
Sinopteridaceae	*Pellaea falcata*	Sickle Fern		**<25**			**x**
Malaceae	*Photinia* sp.*	Photinia	**0**	**<25**			
Rosaceae	*Prunus* sp.*	Flowering Cherry	**<25**	**not seen**			**x**
Ericaceae	*Rhododendron* spp.*	Rhododendron	**0**	**<25**			
Rosaceae	*Rubus fruticosus**	Blackberry	**0**	**<25**	**4**		**x**
Fabaceae	*Senna pendula**	Senna		**<25**		**x**	**x**
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass	**0**	**<25**			**x**
Strelitziaceae	*Strelitzia nicolai**	Bird of Paradise		**<25**			**x**
Commelinaceae	*Tradescantia fluminensis**	Wandering Jew		**<25**	**4**		**x**
Ulmaceae	*Ulmus parviflora**	Chinese Elm	**0**	**<25**			

Polygon B

Polygon B covers an area which still retains many large SBHF canopy tree species. The understorey contains (unmaintained) garden beds and some few native plantings. It is now heavily infested with weeds.

Table B shows the comparative results of the 2007 and 2008 weed surveys. Twenty three (23) new weed species were detected during the 2008 survey. Of these, one (1) is listed as an Environmental Weed by Ku-ring-gai Council (English Ivy *Hedera helix),* and ten (10) are listed as Keystone Weeds (UBM 2007). The Keystone Weeds African Olive *Olea europaea* ssp. *cuspidata*. Japanese Honeysuckle *Lonicera japonica,* Cassia *Senna pendula,* and *Genista monspessulana* have increased in abundance

Table B: Weed Species and Abundance for Polygon B (UBM October 2008)

KEY

New Keystone Weeds

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED		TYPE OF WEEDS		
			B (2007)	B	NOXIOUS AND CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Alliaceae	*Agapanthus praecox**	Agapanthus	**0**	**<25**			
Asteraceae	*Ageratina riparia**	Mistflower	**0**	**<25**			**x**
Asclepiadaceae	*Araujia sericifera**	White Moth Vine		**<25**			**x**
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern		**75-100**	**4**		**x**
Asparagaceae	*Asparagus plumosus**	Climbing Asparagus		**<25**	**4**		**x**
Sterculiaceae	*Brachychiton acerifolius**	Flame Tree	**0**	**<25**			
Poaceae	*Briza subaristata**		**0**	**<25**			
Cannaceae	*Canna indica**	Canna / Yellow Shot	**<25**	**not seen**			**x**
Ulmaceae	*Celtis occidentalis**	Hackberry		**<25**		**x**	**x**
Lauraceae	*Cinnamomum camphora**	Camphor Laurel		**<25**	**4**		**x**
Asteraceae	*Conyza* sp.*	Fleabane	**0**	**<25**			**x**

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED		TYPE OF WEEDS		
			B (2007)	B	NOXIOUS AND CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Rosaceae	*Cotoneaster glaucophyllus**	Cotoneaster		<25		x	x
Iridaceae	*Crocosmia x crocosmiiflora**	Montbretia		<25			x
Poaceae	*Cynodon dactylon**	Couch	0	<25			
Doryanthaceae	*Doryanthes excelsa*	Gymea Lily	0	<25			
Poaceae	*Ehrharta erecta**	Panic Veldt Grass	0	<25			x
Fabaceae	*Genista monspessulana**	Montpellier Broom	<25	25-50	3		x
Araliaceae	*Hedera helix**	English Ivy	0	<25		x	x
Zingiberaceae	*Hedychium gardnerianum**	Yellow Ginger		<25			x
Asteraceae	*Hypochaeris radicata**	Catsear	0	<25			
Bignoniaceae	*Jacaranda mimosifolia**	Jacaranda	0	<25			x
Oleaceae	*Ligustrum sinense**	Small-leaved Privet		<25	4		x
Liliaceae	*Lilium formosanum**	Tiger Lily		<25			x
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle	<25	25-50			x
Moraceae	*Morus alba**	White Mulberry	0	<25			x
Berberidaceae	*Nandina domestica**	Sacred Bamboo		<25			x
Davalliaceae	*Nephrolepis cordifolia**	Fishbone Fern	<25	25-50			x
Ochnaceae	*Ochna serrulata**	Ochna		<25	4		x
Oleaceae	*Olea europaea* ssp. *cuspidata**	Olive	<25	25-50		x	x
Oxalidaceae	*Oxalis pes-caprae**	Soursob	0	<25	5		

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED		TYPE OF WEEDS		
			B (2007)	B	NOXIOUS AND CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Passifloraceae	*Passiflora edulis**	Passionfruit	**0**	**<25**			**x**
Pinaceae	*Pinus radiata**	Monterey Pine	**0**	**<25**			
Plantaginaceae	*Plantago lanceolata**	Plantain	**0**	**<25**			
Rosaceae	*Prunus* sp.*	Flowering Cherry		**<25**			**x**
Ericaceae	*Rhododendron* spp.*	Rhododendron	**0**	**<25**			
Rosaceae	*Rubus fruticosus**	Blackberry		**<25**	**4**		**x**
Crassulaceae	*Sedum* sp.*	Sedum	**0**	**<25**			
Asteraceae	*Senecio madagascariensis**	Fireweed	**0**	**<25**			
Fabaceae	*Senna pendula**	Senna	**<25**	**25-50**		**x**	**x**
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne	**0**	**<25**			**x**
Solanaceae	*Solanum mauritianum**	Wild Tobacco	**0**	**<25**			**x**
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass		**<25**			**x**
Strelitziaceae	*Strelitzia nicolai**	Bird of Paradise		**<25**			**x**
Acanthaceae	*Thunbergia alata**	Black-eyed Susan	**0**	**<25**			**x**
Arecaceae	*Washingtonia* sp.*	Fan Palm		**<25**			**x**

Polygon C

Polygon C covers an area which still retains some large BGHF canopy trees. The understorey contains exotic and native plantings. It is now heavily infested with weeds.

Table C shows the comparative results of the 2007 and 2008 weed surveys. Five (5) new weed species were detected during the 2008 survey. Of these, two (2) are listed as Noxious Weeds (Bridal Creeper *Asparagus asparagoides* and Camphor laurel *Cinnamomum camphora),* and five (5) are listed as Keystone Weeds (UBM 2007). The Keystone Weeds Large-leaved Privet *Ligustrum sinense, Lonicera japonica,* and Fishbone Fern *Nephrolepis cordifolia* have increased in abundance.

Table C: Weed Species and Abundance for Polygon C (UBM October 2008)

KEY

New Keystone Weeds

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED		TYPE OF WEEDS		
			C (2007)	C	NOXIOUS AND CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Alliaceae	*Agapanthus praecox**	Agapanthus	**25-50**	**<25**			**x**
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern		**75-100**	**4**		**x**
Asparagaceae	*Asparagus plumosus**	Climbing Asparagus	**0**	**25-50**	**4**		**x**
Lauraceae	*Cinnamomum camphora**	Camphor Laurel	**0**	**<25**	**4**		**x**
Fabaceae	*Genista monspessulana**	Montpellier Broom		**75-100**	**3**		**x**
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet	**<25**	**25-50**	**4**		**x**
Oleaceae	*Ligustrum sinense**	Small-leaved Privet		**<25**	**4**		**x**
Liliaceae	*Lilium formosanum**	Tiger Lily	**0**	**<25**			**x**
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle	**<25**	**50-75**			**x**
Davalliaceae	*Nephrolepis cordifolia**	Fishbone Fern	**<25**	**75-100**			**x**
Oleaceae	*Olea europaea* ssp. *cuspidata**	Olive		**<25**		**x**	**x**

Passifloraceae	*Passiflora edulis**	Passionfruit	**0**	**<25**			**x**
Strelitziaceae	*Strelitzia nicolai**	Bird of Paradise	**0**	**<25**			**x**

Polygon D

Polygon D covers an area which still retains large BGHF canopy trees. The understorey contains garden beds and some lawn which is now heavily infested with weeds.

Table D shows the comparative results of the 2007 and 2008 weed surveys. Four (4) new weed species were detected during the 2008 survey. Of these, two (2) is listed as Noxious Weeds (Climbing Asparagus *Asparagus plumosus, Ligustrum lucidum*), and two (2) are listed as Keystone Weeds (UBM 2007). The Keystone Weed *Asparagus asparagoides* has increased in abundance, and a new weed Bindweed *Calystegia silvatica* has become rampant.

Table D: Weed Species and Abundance for Polygon D (UBM October 2008)

KEY

New Keystone Weeds

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED		TYPE OF WEEDS		
			D (2007)	D	NOXIOUS AND CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern	**<25**	**75-100**	**4**		**x**
Asparagaceae	*Asparagus plumosus**	Climbing Asparagus	**0**	**<25**	**4**		**x**
Convolvulaceae	Calystegia silvatica	Bindweed	**0**	**<25**			
Poaceae	*Cynodon dactylon**	Couch	**75-100**	**25-50**			**x**
Oleaceae	*Ligustrum lucidum**	Large-leaved Privet	**0**	**<25**	**4**		**x**
Oleaceae	*Olea europaea* ssp. *cuspidata**	Olive	**0**	**<25**		**x**	
Poaceae	*Stenotaphrum secundatum**	Buffalo Grass	**75-100**	**25-50**			**x**

Polygon E

Polygon E covers an area which still retains a few large BGHF canopy tree species. The understorey contains exotic and native plantings as well as and area formerly used as a service area, comprising vegetable garden, a compost area, a chicken coop and other uses. It is now very heavily infested with weeds, particularly exotic climbers and scramblers.

Table D shows the comparative results of the 2007 and 2008 weed surveys. Fourteen (14) new weed species were detected during the 2008 survey. Of these, one (1) is listed as a Noxious Weed (Wandering Jew *Tradescantia fluminensis),* and seven (7) are listed as Keystone Weeds (UBM 2007). The Keystone Weeds *Ipomoea indica* and Nasturtium *Tropaeolum majus* have increased in abundance.

Table E - Weed Species and Abundance for Polygon E (UBM October 2008)

KEY

New Keystone Weeds

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED		TYPE OF WEEDS		
			E (2007)	E	NOXIOUS AND CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Acanthaceae	*Acanthus mollis**	Oyster Plant	**0**	**<25**			
Asteraceae	*Ageratina adenophora**	Crofton Weed		**<25**			**x**
Bassellaceae	*Anredera cordifolia**	Madeira Vine	**<25**	**not seen**	**4**		**x**
Asteraceae	*Bidens pilosa**	Cobbler's Pegs		**<25**			**x**
Poaceae	*Bromus catharticus**	Prairie Grass		**<25**			**x**
Lauraceae	*Cinnamomum camphora**	Camphor Laurel	**<25**	**not seen**	**4**		**x**
Asteraceae	*Cirsium vulgare**	Spear Thistle	**0**	**<25**			**x**
Asteraceae	*Conyza* sp.*	Fleabane		**<25**			**x**
Iridaceae	*Crocosmia x crocosmiiflora**	Montbretia	**0**	**<25**			
Fabaceae	*Dipogon lignosus**	Dolichos Pea	**0**	**<25**			
Rosaceae	*Duchesnea indica**	Indian Strawberry	**0**	**<25**			
Poaceae	*Ehrharta erecta**	Panic Veldt	**0**	**<25**			**x**

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED		TYPE OF WEEDS		
			E (2007)	E	NOXIOUS AND CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
		Grass					
Euphorbiaceae	*Euphorbia peplus**	Petty Spurge	**0**	**<25**			
Fabaceae	*Genista monspessulana**	Montpellier Broom	**0**	**<25**	**3**		**x**
Convolvulaceae	*Ipomoea indica**	Morning Glory	**<25**	**25-50**	**4**		**x**
Oleaceae	*Jasminum polyanthum**	Jasmine		**<25**			**x**
Liliaceae	*Lilium formosanum**	Tiger Lily	**<25**	**not seen**			**x**
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow		**<25**			**x**
Oxalidaceae	*Oxalis pes-caprae**	Soursob		**<25**	**5**		**x**
Urticaceae	*Parietaria judaica**	Sticky Weed	**<25**	**not seen**	**4**		**x**
Poaceae	*Paspalum dilatatum**	Paspalum	**50-75**	**not seen**			**x**
Phytolaccaceae	*Phytolacca octandra*	Inkweed		**<25**			**x**
Plantaginaceae	*Plantago lanceolata**	Plantain		**<25**			**x**
Ranunculaceae	*Ranunculus repens**	Creeping Buttercup	**0**	**<25**			
Asteraceae	*Senecio vulgaris**	Grondsel	**0**	**<25**			
Fabaceae	*Senna pendula**	Senna	**0**	**<25**		**x**	
Solanaceae	*Solanum mauritianum**	Wild Tobacco		**<25**			**x**
Asteraceae	*Sonchus oleraceus**	Common Sow Thistle		**<25**			**x**
Asteraceae	*Taraxacum officinale**	Dandelion	**0**	**<25**			**x**
Acanthaceae	*Thunbergia alata**	Black-eyed Susan	**0**	**25-50**			**x**

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED		TYPE OF WEEDS		
			E (2007)	E	NOXIOUS AND CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Commelinaceae	*Tradescantia fluminensis**	Wandering Jew	**0**	**<25**	**4**		**x**
Tropaeolaceae	*Tropaeolum majus**	Nasturtium	**<25**	**25-50**			**x**
Fabaceae	*Vicia hirsuta*	Hairy Vetch		**<25**			**x**

Polygon G

Polygon G is a new addition since the 2007 survey. It also covers an area which retains a few large BGHF canopy trees. The previous land use is as described for Polygon F. The area is now very heavily infested with weeds.

Table G shows the results of the 2008 weed surveys. Thirty two (32) weed species were detected during the 2008 survey. Of these, five (5) are listed as Noxious Weeds (Asparagus 'fern' *Asparagus aethiopicus, Genista monspessulana, Ipomoea indica, Oxalis pes-caprae* and *Tradescantia fluminensis),* and one (1) Cassia *Senna pendula,* is listed as an Environmental Weed by Ku-ring-gai Council. Eighteen (18) Keystone Weeds (UBM 2007) were recorded in Polygon G.

Table F - Weed Species and Abundance for Polygon G (UBM October 2008)

KEY

New Keystone Weeds

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED	TYPE OF WEEDS		
			G (NEW IN 2008)	NOXIOUS AND CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Acanthaceae	*Acanthus mollis**	Oyster Plant	**<25**			
Asteraceae	*Ageratina adenophora**	Crofton Weed	**<25**			**x**
Asteraceae	*Ageratina riparia**	Mistflower				**x**
Asclepiadaceae	*Araujia sericifera**	White Moth Vine	**<25**			**x**

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED	TYPE OF WEEDS		
			G (NEW IN 2008)	NOXIOUS AND CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Asparagaceae	*Asparagus aethiopicus**	Asparagus Fern	**25-50**	**4**		**x**
Asteraceae	*Bidens pilosa**	Cobbler's Pegs	**<25**			**x**
Poaceae	*Bromus catharticus**	Prairie Grass	**<25**			**x**
Asteraceae	*Cirsium vulgare**	Spear Thistle	**<25**			**x**
Asteraceae	*Conyza* sp.*	Fleabane	**<25**			**x**
Iridaceae	*Crocosmia x crocosmiiflora**	Montbretia	**<25**			
Poaceae	*Ehrharta erecta**	Panic Veldt Grass	**<25**			**x**
Asteraceae	*Euryops abrotanifolius**	Winter Euryops	**<25**			
Papaveraceae	*Fumaria capreolata **	Climbing Fumitory	**<25**			
Fabaceae	*Genista monspessulana**	Montpellier Broom	**25-50**	**3**		**x**
Convolvulaceae	*Ipomoea indica**	Morning Glory	**25-50**	**4**		**x**
Oleaceae	*Jasminum polyanthum**	Jasmine	**<25**			**x**
Malvaceae	*Modiola caroliniana**	Red-flowered Mallow	**<25**			
Oxalidaceae	*Oxalis pes-caprae**	Soursob	**<25**	**5**		
Fabaceae	*Paraserianthes lophantha**	Crested Wattle	**<25**			
Poaceae	*Paspalum dilatatum**	Paspalum	**<25**			**x**
Poaceae	*Pennisetum clandestinum**	Kikuyu Grass	**<25**			**x**
Pinaceae	*Pinus radiata**	Monterey Pine	**<25**			
Plantaginaceae	*Plantago lanceolata**	Plantain	**25-50**			
Ranunculaceae	*Ranunculus repens**	Creeping	**<25**			

FAMILY	SPECIES	COMMON NAME	POLYGON NUMBER AND YEAR SURVEYED	TYPE OF WEEDS		
			G (NEW IN 2008)	NOXIOUS AND CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
		Buttercup				
Fabaceae	*Senna pendula**	Senna			x	
Malvaceae	*Sida rhombifolia**	Paddy's Lucerne	<25			x
Acanthaceae	*Thunbergia alata**	Black-eyed Susan	<25			x
Commelinaceae	*Tradescantia fluminensis**	Wandering Jew	25-50	4		x
Tropaeolaceae	*Tropaeolum majus**	Nasturtium	<25			x
Verbenaceae	*Verbena bonariensis**	Purple Top	<25			
Verbenaceae	*Verbena litotalis**		<25			
Fabaceae	*Vicia hirsuta*	Hairy Vetch	<25			

Former Croquet Lawn

The Croquet Lawn is situated in the north eastern section of the property (adjacent to MZ 1). It has been left unattended for many years and is now dominated by weeds with a number of small native herbs. The soil is heavily compacted and held with a 1.2 metre retaining wall of sandstone blocks. Overall, the area has a % cover of weeds of 75% with native species contribution to 10 % of the vegetation cover.

Table F shows the results of the 2008 survey and contains both weed and native species. A total of thirty (30) species were recorded. Of these twenty (20) weed/garden species were recorded and ten (10) native species were recorded. One (1) Noxious Weed (*Genista monspessulana*) and three (3) Environmental Weeds (Cotoneaster *Cotoneaster glaucophyllus, Box Elder Acer negundo* and African Olive *Olea europaea* ssp. *cuspidata)* were recorded. Eleven (11) Keystone Weeds (UBM 2007) were also recorded.

Table G - Weed Species and Abundance for the Croquet Lawn (UBM October 2008)

** figures in brackets represent a finer scale % cover for 2008, list also includes natives present)*

FAMILY	SPECIES	COMMON NAME	CROQUET LAWN *	TYPE OF WEEDS		
				NOXIOUS AND CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Fabaceae	*Acacia baileyana**	Cootamundra Wattle	**<25 (<15)**			**x**
Fabaceae	*Acacia decurrens**	Green Wattle	**<25 (<15)**			
Fabaceae	*Acacia elata**	Cedar Wattle	**<25 (<5)**			
Aceraceae	*Acer negundo**	Box Elder Maple			**x**	**x**
Asteraceae	*Ageratina adenophora**	Crofton Weed	**<25**			**x**
Poaceae	*Anthoxanthum odoratum**	Sweet Vernal Grass	**<25**			
Poaceae	*Axonopus affinis**	Carpet Grass	**<25**			
Apiaceae	*Centella asiatica*	Kidney Weed	**<25 (<5)**			
Asteraceae	*Conyza* sp.*	Fleabane	**<25**			**x**
Rosaceae	*Cotoneaster glaucophyllus**	Cotoneaster	**<25**		**x**	**x**
Iridaceae	*Crocosmia x crocosmiiflora**	Montbretia	**<25**			
Poaceae	*Cynodon dactylon**(planted as lawn)	Couch	**75-100**			

FAMILY	SPECIES	COMMON NAME	CROQUET LAWN *	TYPE OF WEEDS		
				NOXIOUS AND CLASS	ENVIRON-MENTAL	KEYSTONE (UBM 2007)
Fabaceae	*Desmodium varians*		**<25 (<5)**			
Convolvulaceae	*Dichondra repens*	Kidney Weed	**<25 (<5)**			
Poaceae	*Ehrharta erecta**	Panic Veldt Grass	**25-50**			**x**
Asteraceae	*Gamochaeta americana**	Cudweed	**<25 (<5)**			
Fabaceae	*Genista monspessulana**	Montpellier Broom	**<25**	**3**		**x**
Fabaceae	*Glycine clandestina*	Love Creeper	**<25 (<5)**			
Apiaceae	*Hydrocotyle sp.*		**<25 (<5)**			
Asteraceae	*Hypochaeris radicata**	Catsear	**<25**			
Caprifoliaceae	*Lonicera japonica**	Japanese Honeysuckle	**<25**			**x**
Fabaceae	*Melilotus indicus **	Hexham Scent	**<25**			
Davalliaceae	*Nephrolepis cordifolia**	Fishbone Fern	**25-50**			**x**
Oleaceae	*Olea europaea* ssp. *cuspidata**	Olive	**<25**		**x**	**x**
Plantaginaceae	*Plantago lanceolata**	Plantain	**<25**			
Euphorbiaceae	*Poranthera microphylla*		**<25 (<5)**			
Asteraceae	*Senecio hispidulus var. hispidulus*	Hill Fireweed	**<25 (<5)**			
Acanthaceae	*Thunbergia alata**	Black-eyed Susan	**<25**			**x**
Scrophulariaceae	*Veronica plebeia*	Trailing Speedwell	**<25(<5)**			
Campanulaceae	*Wahlenbergia gracilis*		**<25 (<5)**			

Appendix 5: Keystone & Secondary (Target) Weeds Recorded & Recommended Control Methods

Note: this list of plants to be removed applies **only** to the BGHF habitat areas: not to the landscaped gardens

SPECIES	COMMON NAME	STATUS / COMMENTS	RECOMMENDED METHODS OF CONTROL							
			HAND WEEDING			HERBICIDE APPLICATION				COMMENT / OTHER
			Hand removal	Rake & pile	Dig out	Cut stump & poison	Drill & poison	Scrape & poison	Spot spray	
WOODY WEEDS / GARDEN TREES & SHRUBS										
Acacia baileyana	Cootamundra Wattle	Garden escape/ Environmental weed			✓ (saplings < 0.5 m)	✓	✓			Remove all seedlings if any adult plants are to be retained in the landscaped gardens
Acer negundo	Box-leaf Maple	Garden escape/planting	✓ (seedlings < 5 cm)		✓ (saplings < 0.5 m)	✓	✓			
Brachychiton acerifolius	Illawarra Flame Tree	Garden planting	✓ (seedlings < 5 cm)		✓ (saplings < 0.5 m)	✓	✓			As above
Cinnamomum camphora	Camphor laurel	Noxious weed in LGA/ also cultural planting	✓ (seedlings < 5 cm)		✓ (saplings < 0.5 m)	✓	And/or ✓			As above
Cotoneaster glyciphylla	Cotoneaster	Garden planting	✓ (seedlings < 5 cm)			✓	✓			As above

SPECIES	COMMON NAME	STATUS / COMMENTS	RECOMMENDED METHODS OF CONTROL							
			HAND WEEDING			HERBICIDE APPLICATION				COMMENT / OTHER
			Hand removal	Rake & pile	Dig out	Cut stump & poison	Drill & poison	Scrape & poison	Spot spray	
Gelsemium sempervirens	Carolina Jasmine	Garden planting				✓	✓ (all stems)			
Genista monspessulana	Montpellier / Cape Broom	Noxious weed in LGA	✓ (seedlings < 5 cm)		✓ (saplings < 0.5 m)	✓			✓	
Jacaranda mimosifolia	Jacaranda	Garden escape	✓ (seedlings < 5 cm)		✓ (saplings < 0.5 m)	✓	✓			As above
Ligustrum. lucidum	Broad-leaf Privet	Noxious weed in LGA	✓ (seedlings < 5 cm)		✓ (saplings < 1 m)	✓	✓ (mature plants >1m)	✓ (saplings 0.05 - 1m)	✓ (seedlings < 5 cm)	Noxious and highly allergenic Do not spray when fruit is ripe (treat before late summer)
Ligustrum sinense	Small-leaf Privet	Noxious weed in LGA	✓ (seedlings < 5 cm)		✓ (saplings <1 m)		✓ (mature plants >1m)	✓ (saplings 0.05 - 1m)	✓ (seedlings < 5 cm)	Noxious and highly allergenic
Olea europaea subsp *cuspidata*	African Olive	Environmental weed, but noxious elsewhere	✓ (seedlings < 5 cm)		✓ (saplings <0.5 m)		✓		✓ (seedlings < 5 cm)	

SPECIES	COMMON NAME	STATUS / COMMENTS	RECOMMENDED METHODS OF CONTROL							
			HAND WEEDING			HERBICIDE APPLICATION				COMMENT / OTHER
			Hand removal	Rake & pile	Dig out	Cut stump & poison	Drill & poison	Scrape & poison	Spot spray	
Morus alba	Mulberry		✓ (seedlings < 5 cm)		✓ (saplings <0.5 m)	✓				
Ochna serrulata	Ochna	Environmental weed, but noxious elsewhere			✓ (note kink) (seedlings only)	✓	✓	✓		Taproot with 'kink': liable to break off
Schefflera sp	Qld. Umbrella Tree	Garden escape			✓(<0.5 m)					
Sida rhombifolia	Paddy's Lucerne	Agricultural weed			✓	✓			✓	Long taproot: dig out
Solanum mauritianum	Wild Tobacco Bush	Ruderal weed			✓	✓			✓	
HERBACEOUS WEEDS / GARDEN PLANTS										
Agapanthus praecox	Agapanthus	Garden escape/planting			✓					
Ageratina adenophora	Crofton Weed	Environmental weed/Ruderal	✓		✓				✓	

SPECIES	COMMON NAME	STATUS / COMMENTS	RECOMMENDED METHODS OF CONTROL							
			HAND WEEDING			HERBICIDE APPLICATION				COMMENT / OTHER
			Hand removal	Rake & pile	Dig out	Cut stump & poison	Drill & poison	Scrape & poison	Spot spray	
Ageratina riparia	Mistflower	Environmental weed/ Ruderal	✓		✓				✓	
Asparagus aethiopicus	Ground/Fern Asparagus	Environmental weed, but noxious elsewhere			✓				✓ Brushoff	Hand removal – remove corms in toto Foliar spray -use Brushoff in early spring (preferably)
Asparagus plumosus	Climbing Asparagus	Noxious weed in LGA			✓				✓ Brushoff	
Bidens pilosa	Cobbler's Pegs	Ruderal seed	✓						✓	
Bromus catharticus	Prairie Grass	Pasture grass	✓		✓				✓	
Chlorophytum comosum	Spider Lily	Garden Escape			✓				✓ (surfactant)	
Cirsium vulgare	Spear Thistle	Agricultural weed			✓				✓	Sharp spines: wear gloves
Conyza spp.	Fleabanes	Ruderal weed	✓		✓				✓	
Ehrharta erecta	Perennial Veldt Grass	Environmental weed			✓ (seedlings)				✓	Over plant or mulch thickly. Persistent weed.

SPECIES	COMMON NAME	STATUS / COMMENTS	RECOMMENDED METHODS OF CONTROL							
			HAND WEEDING			HERBICIDE APPLICATION				COMMENT / OTHER
			Hand removal	Rake & pile	Dig out	Cut stump & poison	Drill & poison	Scrape & poison	Spot spray	
Hedychium gardnerianum	Ginger Lily	Garden escape/planting			✓		✓			
Lilium formosanum	Formosa/Easter Lily	Garden escape			✓				✓ (surfactant)	
Monstera deliciosa	Monstera	Garden escape/planting			✓		✓			
Nephrolepis cordifolia	Fishbone Fern	Garden escape/planting			✓				✓ (surfactant)	
Osteospermum ? ecklonis	South African Daily	Garden escape/planting			✓				✓ (surfactant)	
Paspalum dilatatum	Paspalum	Ruderal			✓				✓	
Pennisetum clandestinum	Kikuyu Grass	Turf grass – environmental weed			✓				✓	Scalp soil after foliar herbicide or burn individual tussocks
Parietaria judaica	Pellitory	Noxious weed in LGA	✓ (seedlings)		✓				✓	

SPECIES	COMMON NAME	STATUS / COMMENTS	RECOMMENDED METHODS OF CONTROL							
			HAND WEEDING			HERBICIDE APPLICATION				COMMENT / OTHER
			Hand removal	Rake & pile	Dig out	Cut stump & poison	Drill & poison	Scrape & poison	Spot spray	
Solanum nigrum	Deadly Nightshade	Ruderal weed	✓(seedlings)		✓					
Sonchus oleraceus	Sow Thistle	Ruderal weed	✓							
Stenotaphrum secundatum	Buffalo Grass	Turf grass			✓				✓	
Sporobolus virginicus	Parramatta Grass	Ruderal weed	✓ (seedlings)		✓				✓	
Strelitzia nicolai	Bird of Paradise	Garden escape/planting			✓	✓				
Tropaeolum majus	Nasturtium	Garden escape/planting			✓				✓	
VINES / SCRAMBLERS										
Anredera cordifolia	Madeira Vine	Noxious weed in LGA/garden planting			✓ (tuberlings)		✓	✓	✓ (seedlings)	Gather all fallen tubers and dispose off site
Araujia sericifera	White Moth Plant	Environmental weed			✓				✓ (surfactant)	

SPECIES	COMMON NAME	STATUS / COMMENTS	RECOMMENDED METHODS OF CONTROL							
			HAND WEEDING			HERBICIDE APPLICATION				COMMENT / OTHER
			Hand removal	Rake & pile	Dig out	Cut stump & poison	Drill & poison	Scrape & poison	Spot spray	
Asparagus plumosus	Climbing Asparagus	Garden escape: environmental weed			✓				✓ Brushoff	Hand removal – remove corms in toto Foliar spray - use Brushoff in early spring (preferably)
Hedera helix	English Ivy	Garden planting			✓		✓		✓ (surfactant)	
Ipomoea indica	Morning Glory	Noxious weed in LGA: garden escape			✓				✓ Starane	
Jasminium mesnyi	Primrose Jasmine	Garden escape/planting			✓		✓	✓	✓	Roots at nodes: treat outliers separately
Jasminium polyanthum	Chinese Jasmine	Garden escape/planting			✓ (treat nodes)		✓		✓ (Starane)	
Lonicera japonica	Honeysuckle	Garden escape/planting			✓ (treat nodes)		✓ (old stems)		✓ (Starane)	
Passiflora edulis	Passionfruit Vine	Garden escape/planting			✓				✓	

SPECIES	COMMON NAME	STATUS / COMMENTS	RECOMMENDED METHODS OF CONTROL							
			HAND WEEDING			HERBICIDE APPLICATION				COMMENT / OTHER
			Hand removal	Rake & pile	Dig out	Cut stump & poison	Drill & poison	Scrape & poison	Spot spray	
Thunbergia alata	**Black-eyed Susan**	**Garden escape/planting**			✓				✓	
Tradescantia fluminensis	**Wandering Jew**	**Noxious weed in LGA**	✓ (small plants)	✓					✓ (Starane)	**Foliar spray – use glyphosate early spring when leaf growth is new and soft.. Alternatively, use Starane any season.**
Wisteria floribunda	**Wisteria**	**Garden planting**			✓		✓			

Note: not all weeds recorded in the Subject Property are listed above. Some secondary and/or insignificant weeds have not been targeted for control. However, keystone and major secondary weeds are listed for targeted control actions. Note also that it is entirely possible that other weeds will regenerate after clearing provides additional growing sites.

Appendix 6: List of Locally Indigenous Species Recommended for Planting in Blue Gum High Forest Habitats - Waterbrook at Wahroonga

SPECIES	COMMON NAME	HEIGHT (M)	DENSITY (UNITS/M^2)	COMMENTS
CANOPY TREES (> 20 M)				
Angophora floribunda	Rough-barked Apple	20-30	1/20m^2	Plant in gaps in canopy – moist, deep soils
Eucalyptus saligna	Sydney Blue Gum	30	1/20m^2	Plant in gaps in canopy – moist, deep soils
Syncarpia glomulifera	Turpentine	25	1/20m^2	Plant in moist, well drained soils: attractive in groves
SUB-CANOPY / SMALL TREES & LARGE SHRUBS (> 6 M)				
Acacia implexa	Hickory	7	1/8m^2	Early pioneer species
Allocasuarina torulosa	Forest Oak	8	1/8m^2	Plant in groves 3 – 5 units
Elaeocarpus reticulatus	Blueberry Ash	10	1/10m^2	Ornamental species: attracts birds: sheltered sites only
Glochidion ferdinandi	Cheese Tree	6-8	1/10m^2	
Notelaea longifolia	Native Olive			Slow growing
Omalantbus populifolius	Bleeding Heart Tree	2-4	1/8m^2	Pioneer species useful for re-establishment of community: attracts birds: widespread
SHRUBS				
Breynia oblongifolia	Breynia	2	1/1m^2	Suckers well & will stabilise banks or slopes
Clerodendrum tomentosum	Hairy Clerodendrum	2-4	1/1m^2	Understorey species: shade
Indigofera australis	Indigofera	1.5	1/1m^2	Loose open habit: plant in filtered sunlight, in groves
Leucopogon juniperinus	White Beard-heath	To 1	1/1m^2	Tolerates very dry soils
Pittosporum revolutum	Rough-fruited Pittosporum	2	1/4m^2	Small shrub with colourful fruit: landscape candidate

SPECIES	COMMON NAME	HEIGHT (M)	DENSITY (UNITS/M^2)	COMMENTS
Persoonia linearis	Narrow-leaf Geebung	3	1/4m^2	
Platylobium formosum	Handsome Flat Pea	1	1/1m^2	Full to filtered sun needed
Polyscias sambucifolia	Elderberry Panax	2	1/1m^2	Shady sites under canopy
Rapanea variabilis	Mutton Wood	3	1/4m^2	Hardy pioneer, although slow to grow to maturity
Zieria smithii	Sandfly Zieria	1.5	1/1m^2	Small shrub with open habit
GROUNDCOVERS				
Austrodanthonia tenuior	Wallaby Grass	0.7	4/1m^2	Drier sites
Blechnum cartilagineum	Gristle Fern	0.5	1/1m^2	Moist, sheltered locations: may be hard to establish
Brachycome angustifolia	Brachycome	To 0.2	1/4m^2	Sprawling herb: moist, sheltered position with no foot traffic
Calochlaena dubia	False Bracken Fern	1.5	1/1m^2	As above: may be hard to buy commercially (transplant?)
Centella asiatica	Centella	N/A	1 divot / 5 m^2	Creeping herb: widespread Transplant : use divots
Clematis glycinoides	Old Man's Beard	-	1/5m^2	Can get rampant: prune to contain as required
Commelina cyanea	Scurvy Weed	N/A	1 divot / 5 m^2	Transplant : use divots
Dianella caerulea, D. revoluta	Blue Flax Lily	<1	1/5m^2	Hardy: mass plant in high light situations: landscaped garden beds
Echinopogon caespitosus	Hedgehog Grass	0.5	4/1m^2	High light levels required: edge sites and gaps only
Einadia hastata	Saloop/Saltbush	0.5	1/5m^2	
Entolasia marginata	Bordered Panic Grass	< 0.20	< 0.2	Shade tolerant: very common

SPECIES	COMMON NAME	HEIGHT (M)	DENSITY (UNITS/M^2)	COMMENTS
Eustrephus latifolius	Wombat Berry	N/A	Occasional	Delicate scrambler
Hardenbergia violacea	False Sarsaparilla	-	1/5m^2	Hardy: mass plant in high light situations: landscaped garden beds: edges & slopes
Helichrysum scorpioides	Everlasting	0.3		
Hibbertia scandens	Golden Guinea Flower	-	1/5m^2	Hardy scrambling ground cover: bush or garden beds
Geranium homaenum	Geranium/Cranesbill	0.5	4/1m^2	Widespread sprawling herb: will naturalise by itself
Goodenia heterophylla	Variable Goodenia	0.2-0.3	1/5m^2	
Kennedia rubicunda	Dusky Coral Pea	N/A	1/8-10m^2	Vigorous: may need cutting back: plant small numbers: use on slopes/embankments
Lomandra longifolia	Spiny Mat-rush	1.5	3-4/1m^2	Line watercourses: landscaped garden beds: edge sites: earthen bund
Microlaena stipoides	Weeping Meadow Grass	0.5	4/1m^2	Damp shady sites only
Oplismenus aemulus	Basket Grass	< 0.20	4/1m^2	Widespread in shady/damp soils: transplant plugs or allow to volunteer into site naturally
Poa affinis	A tussock grass	0.6-1.20	4/1m^2	Plant in clumps among other ground covers
Pseuderanthemum variabile	Blue Pastel Flower	0.1-0.3	4/1m^2	Delicate ground cover: will not withstand foot traffic
Themeda australis	Kangaroo Grass	1	4/1m^2	High light levels required: plant on edge sites: mass plant along pathways etc: landscaped garden beds
Tylophora barbata	Tylophora	N/A	4/1m^2	Sprawler/ scrambler: slopes or embankments

Note: that while a small number of the species recommended are not listed in the Final Determination, they do occur quite commonly in local BGHF bushland.

Appendix 7: A Guide to Monitoring Progress of Works in Bushland Rehabilitation Programs

The setting up of a simple monitoring program at the outset of the restoration project is of high importance. Monitoring will provide an objective measurement of progress and record the slow and often subtle changes. A monitoring program will enable the project manager and bush regeneration contractor to assess the performance indicators listed in this report.

As many changes are not readily visible in the short-term, it is recommended that monitoring events be carried out every six (6) months. However data should be collected over a number of years so that trends can be determined. A simple generic guide to monitoring the progress of bushland rehabilitation projects has been included below.

Note that a site-specific monitoring program should be designed for each bush regeneration and rehabilitation site prior to commencement of work.

Establishing Permanent Transects and Quadrats

This method is the traditional way to measure changes in vegetation community structure and diversity. The simplest way to record changes is to count the numbers and types of seedlings regenerating in a measured plot over a period of time.

Establishing permanent transects and quadrats will be sued to monitor Performance Indicators 1, 2, 3, 5, 6, and 7.

In the absence of more specific guidelines in Recovery Plans, for all Management Units, at least one permanent quadrat will be established (as per Threatened Species Survey & Assessment Guidelines NPWS). Sampling is to occur on at least once a year (but monthly for the first six (6) months after treatment).

In addition to the NPWS guidelines, information recorded will include indigenous plant species including the number of naturally regenerating seedlings and cover (using the Braun- Blanquette method).

Baseline data will be collected in each quadrat before the commencement of any ecological restoration works. Sampling will allow for comparison between areas with different soil seedbank treatments, including areas that have not been treated.

Recording of all ecological restoration works will use standard NPWS/DEC recording sheets, and will include hours of weed control performed per bushland management zone or sub-zones.

Choosing the Plot Size

This is often the hardest decision to make: the area has to be large enough to take in the major life forms and small enough to be manageable. In grassland a plot of one (1) m^2 is adequate to gain a representative sample; for shrubs – three (3) m^2 is adequate, but in a treed area, plots of 10 m^2 or larger may be necessary.

Assembling Flora Lists

The assembly of flora lists is basic to all bushland projects. The purpose of the bush regeneration project is not to accumulate an ever-increasing list of new species, but rather to record the diversity and abundance of the existing vegetation community and to monitor any changes that take place as the project proceeds.

Flora lists should be updated regularly and the location(s) of any unusual, rare or threatened species should be marked on the base map and the relevant authorities should be informed (eg. National Herbarium, DECC/NPWS).

In addition to the information recorded in permanent quadrats, comprehensive lists of plant species will be maintained and updated for each management zone. This will be performed as per Threatened Species Survey & Assessment Guidelines NPWS.

Assembling Fauna Lists

The recording of fauna follows the same guidelines as for flora and is of equal importance. In the first instance a simple list of fauna sighted (or evidence of) can be used.

Ultimately, comprehensive (both exotic and native) fauna lists will be compiled and maintained. Data will be collected as per NPWS Wildlife Atlas Format.

Data collected will be used to monitor Performance Indicators 8 and 9.

Assembling a List of Flowering and Fruiting Times

For the native species, a long-term project will be useful since this project calls for local seed collection and propagation.

Adapting weed-clearing activities to coincide with natural seeding times and germination patterns of desirable natives is advised, as clearing weed growth increases germination sites and increases seedling survival chances.

For each indigenous plant species, the flowering and fruiting period will be recorded each year as a week of year figure (i.e. 1 to 52). This is to monitor for pollination and seed set.

Keeping a record of flowering and fruiting times for local weed species can make weed control easier. For example, if it is known that Pampas Grass flowers and as the seed ripens locally between March and May; plan to treat Pampas Grass well before that time. If berry-fruited weeds like Cotoneaster, Lantana or Privet are present, remove the plants before the berries are ripe and attractive to birds.

It is recommended that quantitative measurement be used within each management zone in order to provide information relating to:

- Type and % cover of weed species before and after bush regeneration work;
- Type and % cover of native plant species before and after weed removal; and
- Type and % cover of native plants species regenerating after regeneration.

Monitoring Soil Seed Bank Trials

These trials will allow the testing of a range of strategies designed to stimulate native plant regeneration.

Quadrats will be monitored every three (3) months for 12 months. Results will be quantified by measuring % cover using Braun-Blanquet (see Moore & Chapman 1986), visual analysis and photographs taken from a series of fixed photo-points.

Threatening Processes

All Threatening Processes operating within the BGHF Habitat areas, including those listed as Key Threatening Processes under the State relevant legislation (*TSC Act*) must be noted, and relevant data collected.

Monitoring of any Threatening Processes that occur will be consistent with the relevant Threat Abatement Plans.

Monitoring a decrease in each of the key threatening processes identified for the site is a requirement of Performance Indicator 11.

Photographs

Taking photographs is an easy way to record changes in vegetation structure. A photograph captures the subtle changes that are often missed when working closely on a site over time. Photographs are useful in recording sequence shots at various stages in the project to illustrate the techniques used and the results obtained, and are also valuable teaching tools.

Photography in the bushland environment is not particularly easy for amateurs, as plants cast shadows and without the correct lens filters, everything looks 'green'. Obtain professional advice about ASA ratings and take photographs early in the morning or when conditions are overcast.

A number of permanent photo-points will be selected and marked with a short wooden stake. The location of these photo-points will be recorded on a base map. Photographs will be taken from the same spot every six (6) months.

Other Monitoring Variables

Other useful variables recommended include:

Temperatures - these can be recorded using a wet-dry bulb thermometer. Data may be graphed to show that as the canopy re-forms (regardless of height above the ground) fluctuations of temperature become less extreme. Changes in temperature can be related to the type and numbers of native plants regenerating.

Recording sites (marked and recorded on a base map) can be selected and regular soil temperature readings taken with the bulb just under the soil surface (e.g. 2-4 mm) and air temperature readings taken about two (2) metres above the ground.

Light readings - these may be taken using a light meter, first at ground level, and again at a height of two (2) m. Relate the light intensity to the type and number of native plants regenerating and/or to those already growing on the site.

The lowering of the light levels in a rainforest/closed forest (by reforming the canopy) promotes the regeneration of rainforest canopy species, but reducing light levels in dry sclerophyll woodland or heath decreases the diversity and numbers of indigenous species and promotes the growth of wet gully species and frequently of exotic moisture-loving weeds.

Light readings can be taken in correlation with the soil temperature readings set out above. Readings should be taken both in clearings or light gaps and under the tree canopy.

The health of the litter layer - this can be recorded by observing the cyclical build-up and breakdown of the fallen leaves, the appearance of the soil (whether compacted or friable), the presence of small animals in the litter layer and the production of soil fungi, as indicated by fruiting bodies on the surface and thread-like mycelia in the soil. Simple measurements such as the depth of litter or percentage of groundcover are important. This information will provide clues to other processes occurring on the site over time.

Rainfall readings - these can be obtained from the local meteorological station or taken on site. Determine the local rainfall pattern. Avoid weeding in hot weather when the soil is hard or in the wet season when the ground is so boggy that mud is churned up. Very dry periods are reflected in the survival rate of seedlings, so if tubestock planting is planned, defer planting until regular rains are expected.

Appendix 8: Guidelines for the Protection of Bushland during Construction

Erosion Control Measures

- Soil erosion, sedimentation, stormwater management and drainage controls must be properly planned and be fully operational in advance of any construction activity. Silt fences must be erected and/or sediment basins constructed on the site prior to any excavation/earthworks commencing. This includes preliminary work such as clearing, or under-scrubbing of existing vegetation.
- Sediment basins, retardation basins and other forms of protection are to be provided by the developer/contractor downslope of the construction site and maintained free of sediment for the duration of the project. A weekly inspection by Council's Health and Building Officer is strongly recommended. Supplementary inspections should be undertaken immediately after each heavy rain event.
- At no time should temporary spoil dumps to be established in bushland during construction. All soil is to be retained on the construction site and stabilised to prevent wash. Temporary soil erosion measures include the use of fixed straw bales, geofabric fences or a cover crop (eg. a hybrid or annual grass).
- Stabilisation of bare soil areas with appropriate hybrid grasses such as Rye Corn (autumn/winter) or Japanese Millet (spring/summer), weed-free mulch, or erosion-control fabrics should be undertaken to a standard determined by Council within a reasonable period of time: the usual time allowed is 7 days from clearing.
- The rehabilitation of road batters, service roads and other exposed soil surfaces remaining after construction work is to be carried out promptly and to Council specifications.

Stormwater Runoff Control

- Stormwater from the development site must not be allowed to flow into bushland outside the construction 'envelope' or into adjacent property. Collected stormwater from the development site must be discharged by piping to a natural watercourse, with as little disturbance to bushland as possible.
- Where distance from a natural watercourse prevents such direct piping, siltation basins and energy dissipaters should be installed at the discharge point. These should be constructed to a stable sub-grade with energy dissipaters and sedimentation collection areas installed to Council specifications. Such areas are to be maintained at the developer's expense.
- No runoff water from the construction site is to be directed downslope into bushland, and particularly no runoff water is to be allowed to impact on existing trees on the site (eg. wash or pooling of water). Water used during the construction phase containing, or potentially containing pollutants, is to be stored in an appropriate manner (as directed by Council) and removed off-site at the developer's expense.

Placement of Essential Services through Bushland

- When water pipes, sewers or gas mains are to be laid through bushland the following procedure should apply:
- All existing and potential service corridors through bushland should be identified, marked and thoroughly weeded before any construction work commences.
- Eradication of noxious and/or target environmental weed species should also be carried out for a minimum distance of three (3) metres on either side of the service corridor. A list of target weeds and recommended measures for control are provided in the body of this report.
- All trees to be retained should be identified and protected with appropriate guards. Guards should be erected at the canopy line, not at the trunkline. There must be no parking of vehicles underneath trees (to avoid root compaction,) and no soil is to be stockpiled under these trees.
- All weed-free native leaf litter (leaves, bark, twigs, branches) and any large timbers are to be removed and stockpiled for future use;
- All topsoil from the area is to be excavated, placed into windrows no greater than 1 metre in height, and stored separately from other excavation material;
- Topsoil and leaf litter are not to be stored for periods of more than three months from the date of clearing: topsoil may be covered and stabilised to prevent soil wash and weed infestation during the storage period;
- Backfilling trenches or excavations with clay fill or other imported material will not be permitted without written permission from Council;
- Following construction, the original (stored) topsoil is to be replaced in the excavation in the correct sequence (eg. subsoil first, topsoil last);
- Stored leaf litter and timbers are to be scattered over the exposed surface;
- Where leaf litter is scarce or the site is on steeply sloping land, additional rehabilitation work is recommended. Stabilisation methods include brush matting (layering); hand broadcasting of seed; and planting of indigenous tubestock. It may be necessary to use a combination of methods to achieve sufficient plant density eg. brush matting plus tubestock planting.
- Maintenance weeding on the construction, site and in the adjacent buffer zone (approximately 3 metres wide) must be carried out by the developer for minimum period of twelve (12) months or until the site is re-vegetated and the surface soil is stabilised.

Protection of Nearby Vegetation

- No encroachments into adjacent bushland are permitted for access of machinery, for traffic control, or for the stockpiling of overburden or other construction material.
- The construction site must be secured with fences/gates for the duration of the project, and there should be restricted access for construction vehicles (including parking, turning circles) and minimal entry points. Parking should be provided off-site.
- Any (unavoidable) nominated access roads through bushland should be clearly defined by an exclusion fence along both boundaries.
- Protective tree guards and exclusion fences should be erected prior to construction and maintained to protect existing vegetation and rock formations.
- Measures to avoid and minimise the spread of exotic plants and other weeds into bushland from the development site must be undertaken prior to construction. The control of noxious weeds on the development site is the legal responsibility of the landowner.
- Eucalypts are notoriously sensitive to changes in hydrology. All attempts should be made to retain existing drainage patterns, and where changes are unavoidable, long-term plans should be made to provide replacements for affected trees.

Appendix 9: Curricula vitae

JUDITH LOUISE RAWLING

BA • DipEd• Dip EnvStud.• MEnvStud • MAIBiol • MEIA •MESA • Vice President ECA (NSW)

PERSONAL DETAILS

Name:	Judith Louise Rawling	
Citizenship:	Australian/Canadian	
Health:	Excellent	
Address:	Business:	Building P5, Yarramundi Road, University of Western Sydney, RICHMOND NSW 2753
	Home:	"St Clements", 1238 Bells Line of Road KURRAJONG HEIGHTS NSW 2758
Telephone:	Home:	(02) 4567 7979
	Business:	(02) 4578 5992
	Mobile:	0414 886 219
Fax:	Home:	(02) 4566 7979
	Business:	(02) 4578 0822

CURRENT POSITION

- 1990 – present *Managing Director* – Urban Bushland Management Consultants Pty Ltd and
- *Principal* – Urban Bushland Management Projects Pty Ltd.
- Set up *Urban Bushland Management Consultants* in 1990 – a company specialising in planning and consultancy in the field of natural resource management along with "hands–on" contractual work rehabilitating degraded bushland remnants in the urban environment.
- Management of consultancy and contracting services.
- 2000 Winner of Hills Excellence in Business Award for Excellence in Environmental Management & Contribution.
- Provision of consultancy services on bushland management. This includes survey design and implementation, mapping, report writing, advice on the impact of government policies, etc.
- Planning and supervision of the work of 60 field staff, on an average of 30 concurrent projects in Sydney/Wollongong/Central Coast/Blue Mountains.
- Liaison and negotiation with municipal and shire councils and other landholders on contracts and continuing work.
- Preparation and implementation of project budgets, including salaries, equipment purchase, costing of special tasks, etc.
- Course design, field exercise planning and teaching, and other participation in training courses for bush regenerators.
- Publicity activities – preparation of newsletter and other publications, displays, speeches to community groups.

- Nominee for the Eureka Prizes (Excellence in Scientific Research), an honor which recognises contribution to the field of Restoration Ecology.
- Extensive experience teaching biology and environmental studies in Australia, Canada and Britain and part–time lecturing at a number of universities in Australia.
- Author of numerous publications and conference papers.
- Employed as a specialist associate–consultant for a number of large firms, including Landscan/DEM, EDAW (Australia), Hyder Consulting, Gutteridge Haskins & Davey, AMBS and Pittenridgh, Shinkfield and Bruce, Colin Ging & Partners, Carson Group, Murlan Consulting.

COMMITTEE AND OTHER MEMBERSHIPS

Professional Memberships

- Member, Environment Institute of Australia, 1993 – present
- Member, Australian Institute of Biology, 1991 – present
- Member, Municipal Conservation Association, 1995 – present
- Member, Weed Society (NSW) 1986 – present
- Member, National Trust of Australia (NSW) 1986 – 1995, 1999 – present
- Member, Australian Garden History Society 2000-present
- Ecological Consultants Association (NSW), Council Member 1999–present, Member of the Executive 2003 -2008. Current 2008/09 Vice-president

Committee Memberships

- Member, Hawkesbury–Nepean Catchment Trust: Revegetation Steering Committee 1994 – 1996
- Member, Lane Cove Catchment Management Committee – 1990 – 1996
- Member Cattai Catchment Management Committee 1998 – 2000
- Discovering Alternatives to Garden Escapes ('Grow Me Instead') Steering Committee, for Nursery & Garden Industry Association 2003 - present
- Member, Hawkesbury Rainforest Network – Executive Member 2001-2004
- Member, NSW Noxious Weeds Advisory Committee to the Minister, Department Primary Industries, 1993 – present

EMPLOYMENT HISTORY

1989 – Present **Various TAFE colleges**
Guest Lecturer

1995 **University of Western Sydney**
Part Time Teacher

1993 – 1995 **University of Sydney**
Part–time Teacher, Continuing Education

1986 – 1990 **National Trust of Australia (NSW Division)**
Bush Management Officer

- Responsible for the planning and management of the Trust's Bush Management Program B.A., Business Administration and Computer Science.

1989 University of Technology, Sydney
Guest Lecturer, School of Biological Sciences

1985–86 and 1988–89 Macquarie University
Part–time Tutor Environmental Studies.

1964–1985 Sydney, Canberra, Oxford, London and Montreal
Teacher, Senior Biology and Science

- Design and implementation of new courses in the ACT secondary system, including those for tertiary accreditation
- Environmental education field trips throughout the ACT and the Sydney region, and to the Barrier Reef, the Snowy Mountains area, and Central Australia
- Supervision of graduate teacher trainees. Mentor program.

EDUCATIONAL QUALIFICATIONS

1989 Macquarie University Sydney

- **Master of Environmental Studies**
- Thesis title: The Ecology and Distribution of Pampas Grass (Cortaderia selloana) in Sydney Bushland
- Concurrently with Masters Degree studies (1984–87) undergraduate courses at Macquarie University: Introductory Statistics, Plant Structure and Function, Introductory Ecology.

1982 – 1983 Macquarie University Sydney

- **Diploma in Environmental Studies**
- Courses completed: Principles of Environments, Chemicals in the Environment, Aspects of Urban Ecology, Natural and Managed Ecosystems, Environmental Impact Assessment, Environmental Policy and Law, Social Impact on Environments, Australian Ecosystems

1971–72 Canberra College of Advanced Education Canberra

- **Graduate Diploma in Education**

1969–70 and 1976 Australian National University Canberra

- Courses completed: Vertebrate Ecology, Animal Ecology, Theoretical Zoology, Animal Behaviour, Human Ecology.

(*NOTE: All the above studies were completed part–time while in full–time employment)*

1961 – 1964 University of Ottawa Canada

- **Bachelor of Arts**
- Studies in English, French, Philosophy, Biology, Classics, Mathematics

LICENSES

- National Parks & Wildlife Scientific License Section 132C, NP Act 1974. Licence No. S10411
- Class A Drivers License

ADDITIONAL TRAINING

- Bush Fire Personnel Basic Training Program – ACT Bush Fire Council
- Alpine Ecology Course – Department of Conservation and Natural Resources, Falls Creek, Victoria
- Human Resource Management – University of Sydney, Centre for Continuing Education, 1991
- Botany and Ecology of the Sydney Region – University of Sydney, Centre for Continuing Education, 1991
- Chainsaw Use and Maintenance
- Seed Collection Workshop, Ku–ring–gai Municipal Council
- Grasses and Sedges Identification Workshop

BELINDA PELLOW

PERSONAL INFORMATION

Name	Belinda Pellow
Citizenship	Australian
Health	Excellent
Address	Building P5 Yarramundi Road University of Western Sydney (Hawkesbury) RICHMOND NSW 2753
Telephone	(02) 4578 5992
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Email	bpellow@urbanbushland.com.au

Memberships

Member, Australian Systematic Botany Society
Member, Ecological Society of Australia

CURRENT POSITION

March 2007 – Present Sydney

- ***Senior Botanist*** **– Urban Bushland Management Ecological Consultants**
- Conducting botanical surveys and assessments throughout the Sydney Region, including community descriptions, compiling inventories, targeted searches for threatened ecological communities and species.
- Report preparation including assessment of conservation significance and opportunities and constraints; vegetation management strategies; plans of management; 7–part tests and Species Impact Statements.
- Background research, database searches, literature reviews
- Preparation of maps and other graphics, and compilation of reports.

EDUCATIONAL QUALIFICATIONS

1990 South Australian College of Advanced Education Australia
Associate Diploma of Arts (Aboriginal Studies)
1977 Riverina College of Advanced Education Australia
Diploma in Applied Science (Agriculture)

EMPLOYMENT HISTORY

2000 – Present
Curator - Janet Cosh Herbarium, University of Wollongong (Part-Time)
2007
Contract Botanist - Federal Department of Environment and Water

Preparation of weed species profiles for the FDEW webpage.

2005 - 2007

Botanist

Conducted a full revision of the 'Flora of the Sydney Region' (Carolin and Tindale 1994), and preparation for publication and presentation on the web.

2005 to 2007

Botanist - John Ray Herbarium, University of Sydney

Curation of specimen collection

2004 to 2005

University of Western Sydney

Initiated and co-organized Symposium on the Cumberland Plain Woodlands held at University of Western Sydney, February 2005

2003

Botanist

Nomenclatural proofing, compilation of index for scientific and common plant names, compilation of bibliography for the publication 'Ocean Shores to Desert Dunes: Vegetation of NSW' Keith, D. 2004

2003 to 2005

Australian Plants Society, Sutherland Group

Contributions to the production of the plant identification CD 'Coastal Plants of the Royal National Park' (2006).

2002

Contract Ecologist - University of Melbourne

Preparation of species profiles for analysis of extinction risk to test threatened species assessment protocols.

2001

Contract Ecologist

Determination of selected plant species range sizes for research into IUCN assessment procedures.

1998 to 1999

Technical Officer - Tasmanian Herbarium

Revision of the Cunoniaceae.

1997

Technical Officer - Parks and Wildlife Service, Tasmania

Surveys of threatened plant species.

1996

Volunteer - Tasmanian Herbarium.

1992-1995

Herbarium Officer - Janet Cosh Herbarium, University of Wollongong.

1983-1989

Joint Convener - Centre for Continuing Education, Sydney University.

Teaching and administration for a course entitled "Botany and Ecology of the Sydney Region."

1980-1990

Technical Officer - John Ray Herbarium, Botany Department, Sydney University.

PUBLICATIONS

Pellow, B., Henwood, M. & Brownlee, R. (2007). eFlora of the Sydney Region: 'Shortening the distance between discovery and delivery' (GTI 1998*). Australian Systematic Botany Society Newsletter*. In Press.

Henwood, M., Hanfling, S., Brownlee, R., Gutsche, T. & Pellow, B. (2006). Sowing seeds in the digital garden.

Proceedings of Sustainable data from digital fieldwork Conference; December 2006. Ed. Barwick, L. & Thieberger, N. Sydney University Press: Sydney. 147 – 156.

Pellow, B. (2005). A Woman's Legacy to Botany. *WISNET Journal* 69: 16 -17.
Pellow, B. &. Porter, J. L. (2005) A new species of *Goodenia* (Goodeniaceae) from Nocoleche Nature Reserve, Far Western Plains, New South Wales *Telopea* 11(1): 35–41
Keith, D & Pellow, B. (2005). Effects of Javan Rusa Deer (*Cervus timorensis*) on Native Plant Species in the Jibbon-Bundeena Area, Royal National Park, New South Wales. *Proc. Linn. Soc. NSW*. 126: 99 – 110
Keith, D. A., McCarthy, M. A, Regan, H., Regan, T., Bowles, C., Drill, C., Craig, C., Pellow, B., Burgman, M.A., Master, L. L., Ruckelshaus, M., Mackenzie, B., Andelman, S. J. & Wade, P. R. (2004). Protocols for listing threatened species can forecast extinction. *Ecology Letters* 7: 1101 – 1108
Rozefelds, A. C., Barnes, R. W. & Pellow, B. (2001). A new species and comparative morphology of *Vesselowskya* (Cunoniaceae). *Australian Systematic Botany* 14: 175 – 192
French, K. Pellow, B. & Henderson, M. (2000). Vegetation of the Holsworthy Military Area. *Cunninghamia* 7(3): 983 – 939
Rosefelds, A. C. & Pellow, B. (2000). A new species of *Gilbeea* (Cunoniaceae) from north-eastern Queensland, Australia. *Nordic Journal Of Botany* 20(4): 435 – 442.
Keith, D. A. & Pellow. B. J. (1990). Temperate moorland vegetation: a comparative study of Tasmania and the Australian mainland. *Report on a Wilderness Ecosystems Baseline Study to the Tasmanian Department of Parks Wildlife and Heritage.*

INTERESTS

- Plant identification and systematic.
- Vegetation surveys of urban bushland.
- Botanical education and training.
- Curation and management of herbarium specimens and associated historical material.

KYLIE REED

PERSONAL INFORMATION

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Health	Excellent
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MEMBERSHIPS

Associate Member - *Ecological Society of Australia*

CURRENT POSITION

April 2008 – Present Sydney

- ***Field Ecologist (Zoology)*** **– UBM Ecological Consultants**
- Conducting fauna surveys and assessments throughout the Sydney Region, including community descriptions, compiling inventories, targeted searches for threatened species and populations.
- Assisting in botanical surveys and assessments throughout the Sydney Region, including community descriptions, compiling inventories, targeted searches for threatened ecological communities and species.
- Report preparation including assessment of conservation significance and opportunities and constraints; vegetation management strategies; plans of management; 7–part tests and Species Impact Statements.
- Background research, database searches, literature reviews
- Preparation of maps and other graphics, and compilation of reports.

EDUCATIONAL QUALIFICATIONS

2007 University of Wollongong

Bachelor of Environmental Science (Advanced) with 1st Class Honours in Life Sciences

Honours Thesis with High Distinction as requested by Shoalhaven City and Kiama Municipality councils with the topic "Impact and habitat of Indian Myna birds in the south coast region".

EMPLOYMENT HISTORY

February 2008 – September 2008

Project Support Officer – Omega Environmental (Casual basis)

Compiling data inventories in ICLEI software for councils participating in the Cities for Climate Protection program. Report preparation including data analysis and interpretation.

RELEVANT EXPERIENCE

2008

Environmental Project Officer – Kiama Municipal Council

Work Experience Program

Updating Common Myna information on the Council Website. Educating local community groups on the ecology and breeding habits of the Common Myna. Onsite visits to proposed regeneration sites within the municipality. Brainstorming ideas for 'Sustainable Living in Kiama' scheme.

2005

NPWS Officer – Booderee National Park

Work Experience Program

Re-vegetation of native species in areas once affected by Bitou Bush. Counting and sorting of insects for mammal research. Daily park inspections and work. Plotting and locating areas of bushfire and endangered species using Excel and GIS.

2005

Bushcare Coordinator - Bushcare Volunteers Program

Work Experience Program

Organising Conjola Bushcare group for the spray of Bitou Bush in foredune and hinddune locations. Meeting up with National parks and locating Bitou sites around Swan Lake by boat.

2001

Threatened Species Officer – Shoalhaven City Council

Work Experience Program

Targeted searches for threatened ecological communities, populations and species in the Shoalhaven LGA. Identification of flora species to be placed in a personal herbarium of native vegetation in South-eastern NSW. Preparation of maps and other graphics, and compilation of reports and letters.

SKILLS AND ATTRIBUTES

Excellent understanding of Environmental sciences, issues and systems.

Excellent collaboration and communication skills with professional and university peers.

High performance in oral presentation and written reporting.

Flexible; able to work well independently and as part of a team in high stress environments..

Practical experience in flora and fauna field surveys.

Excellent time management and organisational skills in problem-solving, incorporating critical thinking and creativity.

Excellent verbal public communication skills.

Proficient in Microsoft word, Excel, PowerPoint and GIS.

OTHER QUALIFICATIONS

- Senior First Aid Training (2007)
- Class C Drivers License
- The Queen's Scout Award
- PADI Scuba diving certification
- Leadership Course - Scouts Australia
- Initiative Course – Scouts Australia

GABRIEL WARDENBURG

PERSONAL INFORMATION

Citizenship	Australian
Health	Excellent
Address	Building P5 Yarramundi Drive University of Western Sydney (Hawkesbury) RICHMOND NSW 2753
Telephone	(02) 4578 5992
Fax	(02) 4578 0822
Email	gabriel@urbanbushland.com.au

CURRENT POSITION

2008 - Present
***GIS Officer* – Urban Bushland Management Ecological Consultants**

- Design and preparation of maps and photos using GIS software (MapInfo);
- Field Investigations - GPS mapping of vegetation communities, habitat mapping, management issues, soils, topography and surrounding land uses.
- Background research including literature reviews and database searches.
- Various office administrative tasks (as required).

EDUCATIONAL QUALIFICATIONS

2005 - 2007 Macquarie University Australia
Bachelor of Environmental Management
2004 Kings College London Australia
Bachelor of Arts (Geography)

EMPLOYMENT HISTORY

2004-2006 *Market Research* – Colmar Brunton
Assistant Field Project Leader (Temporary)
Co-ordinating with Project Leader
Reporting on Daily Progress
Managing Respondent Quotas
Distributing Respondent Re-imbursements
Working Autonomously
Briefing Staff

Interviewer (Casual)
Data Entry
Group Discussion Moderator
In-Depth Interviewer

Computer Assisted Telephone Interviewer
Recruiting from Panel
Product Testing Interviewer

SKILLS AND ATTRIBUTES

Languages
Fluent in German

SOFTWARE LITERACY

ArcGIS 9.1 (ESRI)
MapInfo 9.0 (MapInfo)
SPSS 15.1 (SPSS Inc.)
Office 2007 (Microsoft)
Acrobat CS3 (Adobe)
Photoshop CS3 (Adobe)
Flash CS3 (Adobe)

ACHIEVEMENTS

Vienna Boys Choir
Gained entrance in 1993
Toured in America, Taiwan, Germany and England
Performed at The White House, Royal Albert Hall, Royal Carnegie Hall, Vienna State Opera House and other high profile venues

MUSICAL ACHIEVEMENTS

Grade 8 Clarinet
1st Clarinet – College Orchestra

EXTRA-CURRICULAR ACTIVITIES

2007 *Voluntary Work* - Planet Ark/Ryde Council
Bush Regeneration Projects
Assisting with tree planting efforts