



COLAC BOTANIC GARDENS

MASTERPLAN REVIEW

2012

PREPARED FOR THE SHIRE OF COLAC OTWAY

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March, 2012.

ACKNOWLEDGEMENTS:

Members of the Friends of Colac Botanic Gardens, particularly, Anne Mercer, Helen Paatsch, Ros Scanlan among others
Rob Small, CEO, Shire of Colac Otway
Neil Allan, General Manager Infrastructure & Services, Shire of Colac Otway
Laurence Towers, Horticulturist, Colac Botanic Gardens

The Living Plant Collections Plan and Collection Management Plans in general follow the framework developed and used by the Royal Botanic Gardens Melbourne, and BGANZ Victoria.

COLAC BOTANIC GARDENS

Master Plan

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INTRODUCTION

The Site

This master plan provides a planning framework for the (approximately) 16 hectare Colac Botanic Gardens ('the Gardens'), which is located at 1-5 Fyans Street, Colac.

The site is a Crown Reserve (RS 1092) and is managed by the Shire of Colac Otway on behalf of the State Government's Department of Sustainability and Environment. A detailed and comprehensive account of the history and development of the Colac Botanic Gardens is contained in *Colac Botanic Gardens – A Conservation Study*, prepared for the then Shire of Colac by Patrick & Wallace Pty Ltd in 1993. This report will not seek to repeat that information, but rather refer as appropriate to that document as a key reference. The Patrick & Wallace report also provided extensive and detailed recommendations for improvements to built elements, development of the living landscape, public access, interpretation and education.

From a landscape design point of view, the Garden is quite unusual in that it is the product of design input from two of Victoria's most prominent botanic garden designers: Daniel Bunce (Director of Geelong Botanic Gardens), who laid out the original garden around 1868, and William Guilfoyle (Director of the then Melbourne Botanic Gardens) who provided recommendations to remodel the Colac site in 1909. While Guilfoyle's improvements appear to not have been fully implemented, the influences of these two notable figures can still be 'read' in the landscape.

The Patrick & Wallace conservation study provided a policy framework with the aim of ensuring that the historic fabric and elements of the Gardens is conserved, while recognizing the need for the Gardens to meet modern demands and accommodate various recreational activities. The Conservation Policy Statements are attached in Appendix E.



Copy of historic plan of (c.1910) Colac Botanic Gardens, showing William Guilfoyle's recommended changes to the landscape.

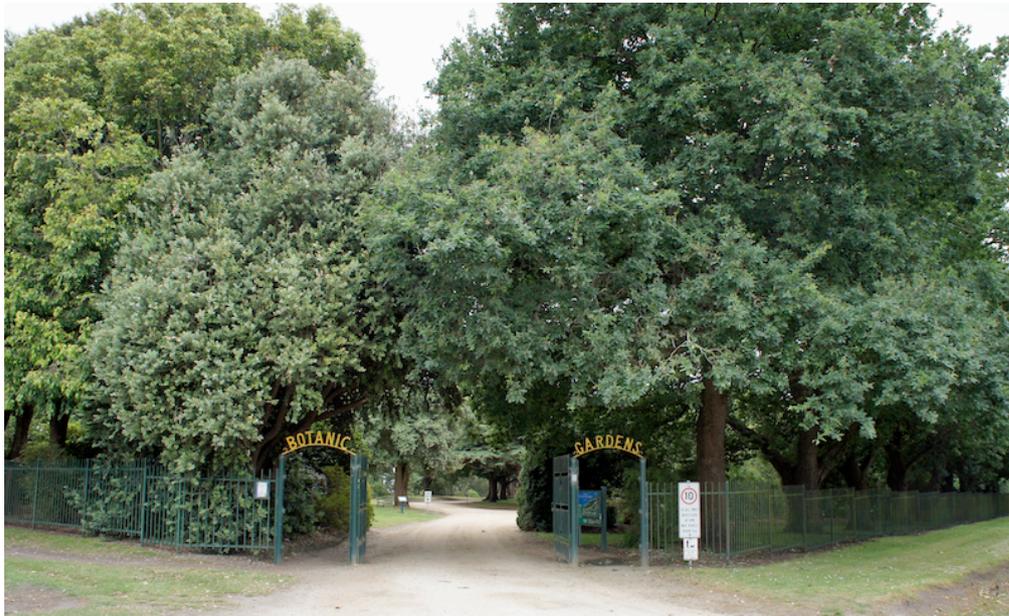
Heritage Registration

The Colac Botanic Gardens was added to the Victorian Heritage Register in December 2010. The registration citation, including a detailed assessment of the historical significance of the site, is listed in Appendix D. The citation concludes that ‘the Colac Botanic Gardens are of historical, aesthetic, and scientific (botanical) significance to the State of Victoria.’

Purpose of this document

The purpose of this master plan document is to provide policies, guidelines and prioritized steps to guide the continuing management and improvement of the Gardens, while being cognisant of its conservation status. It is important to recognise that the roles of botanic gardens within our communities have evolved over recent decades. Botanic gardens now play a key role in plant conservation worldwide, and are guided by the aims and priorities of the Botanic Gardens Conservation International (BGCI). One of the key priorities in the BGCI’s global plant conservation strategy is a focus on conservation of endangered flora of the local area – in this case the south-west basalt plains and the Otway Ranges. Botanic gardens are ideally placed to not only play an active role in the conservation of their local flora, but to also display material and educate their communities about the importance of plant conservation for life on earth.

Master plans such as this must therefore find a balance, being respectful of the need to conserve (as appropriate) historic planting, structures and layout of a site, while considering the needs of the modern user, the need for renewal and sustainable planting frameworks, and broader plant conservation objectives.



The Bilson Gates at the western entry to Colac Botanic Gardens at corner of Gellibrand & Fyans Sts.

Notwithstanding the potential effects of a changing climate on plant growth and survival, an additional consideration is the longer-term outlook for Lake Colac which has (during the recent drought) had an extended period of low water levels and retracted shoreline. As at winter 2011 the lake has refilled to a great extent, but one must consider that in the absence of new sources of inflow to the lake, low water levels may be more common. In these events, it may be argued that visual access to the lake shore from within the Gardens loses some aesthetic desirability, and that the planting below the terraces should provide at least some visual softening (or partial screening) of the shoreline.



Looking north to Lake Colac in winter 2011.

LIVING LANDSCAPE

Tree Collection

The CBG boasts a very well established framework of mature trees, including the mixture of oaks and occasional *Corymbia spp.* along the carriage loop drive. The trees define the spaces within the gardens, and frame important views, in addition to providing valuable protection from strong winds off Lake Colac.

Many of the trees on site are mature, some are over-mature (in a senescent state), and there has been a reasonable amount of new tree planting, particularly over the past decade (2000 – 2011).

In general terms, it is desirable to achieve a sustainable ‘mixed-age’ tree collection, to ensure that these important elements of the CBG landscape will always be providing a valuable contribution. To achieve this, it is necessary to categorise existing trees according to their age and (particularly) their expected functional life span. ‘Functional life-span’ is a term that describes the period during which a tree makes a positive contribution to the landscape – in other words, it is not necessarily the tree’s absolute life-span (though some special trees may make a positive contribution right up to and indeed after their death, such as venerable River Red Gums, which may have significance through association with local indigenous people).



Colac Botanic Gardens, western lawn, looking east.

For example, most of the older specimens of *Pinus radiata* along the northern side of the CBG, on or below the terraces are nearing the end of their functional life. Because of the important role that they play in providing a windbreak, a sensible approach of selected removal and replanting with more botanically interesting species of pine or related genera has been occurring over several years. This practice should continue in a gradual fashion, rather than undertaking wholesale

removals with the consequent exposure to strong winds that would ensue. In this zone, some group plantings of the upright *Cupressus sempervirens* (Italian Cypress) would add visual interest, and be appropriate for the challenging growing conditions.

A more difficult challenge over time will be the regeneration of the avenue of oaks (mainly) along the carriage loop drive, as the trees become over-mature. Because of the difficulty in establishing new individual trees within an existing planted row or avenue, the most effective option may be to remove and replace blocks of several trees in a section, and staging removals in this way over a number of years to minimize the loss of visual amenity.

It is suggested that as the opportunity to replace the *Corymbias* in the carriageway avenue arise, that consideration be given to oaks, for the sake of uniformity of the avenue planting, though it is recognized that the existing *Corymbia* was planted to commemorate Federation (1901), and another was planted to mark the centenary of that event (2001).



View west from near Fyans Street gate, under Araucaria bidwillii (Bunya Bunya).

The CBG landscape (the upper area of 'botanic gardens zone') is currently close to 'full' capacity with regard to tree planting. A balance needs to be maintained between the planted 'mass' areas, and the space 'void'. Significant views need to be kept open, and in places, undesirable views need to be kept screened. **It is therefore recommended that there be no further major increase in the tree population of the CBG.** New plantings may occur of course, in order to increase the diversity within the chosen living collections of the site, or if other botanically interesting taxa (suitable for growth in the local conditions) are available, but these should be balanced by removals, so the status quo remains more-or-less constant.

Recognising the high percentage of mature tree specimens within the site, a reasonable aim in principle would be to seek to change over approximately 5-10% in each decade, to work towards a truly mixed-age canopy. The result is that at the end

of each 100-200 years, all the trees (with the exception of any with intrinsic irreplaceable value) may be replaced. The figures provided have intentionally been left quite non-specific, as the equation should be considered as a general guideline, not a prescription for removal of trees will-nilly.

As with any significant tree removals, provision of information to the local community is important, so that there is an opportunity for explanation of the rationale for the removals, and that the plan for planting of new trees is understood, if not embraced.

In general terms, there is a good argument for seeking to retain the existing diverse mix of tree forms, types (woody trees and palms, evergreen and deciduous, gymnosperms and angiosperms) and general distribution (within beds, in avenues and as lawn specimens). Tree removals should do not necessarily dictate the need for replacing 'like with like' – for example the removal of a specimen of *Pinus radiata* or *Cupressus macrocarpa* presents an opportunity for replanting a more botanically interesting species that adds value from a living plant collection perspective. Positioning of replacement trees may also need further consideration, as the growth of other garden elements and changing views may mean that an adjusted location would be preferred.



Mixture of senescent and younger pines (predominantly Pinus radiata) on the northern slopes. The trees in this zone perform a valuable role as a windbreak.

Recommendations:

- **That the current tree population and density within the site be maintained through selected removals and new plantings;**
- **That the new plantings take account of significant view-lines, and the need to keep certain vistas clear;**

- **That new plantings improve the botanical diversity of the CBG collections, and where possible that they augment the priority living collections;**
- **That the oak avenue be rejuvenated in sections, when the need arises;**
- **That in the sections of the carriageway avenue that are currently not oak species (eg. *Corymbia spp.*) consideration be given to replacement with oaks, when the current trees require removal and replacement.**

Tree Collections: Links to Colac Streetscapes

The streetscapes of Colac, particularly those in the section between Murray Street and southern shores of Lake Colac are planted with various species of street trees, including Planes (*Platanus spp.*) Queensland Brush-box (*Lophostemon confertus*), various Ash species (*Fraxinus spp.*), Oaks (*Quercus spp.*) and Elms (*Ulmus spp.*, mainly *U. procera* and *U. X hollandica*). Well-planned and maintained street tree planting can provide a range of benefits: aesthetic (overall appearance of the street), environmental (modifying local temperatures in the hotter months by shading pavements and dwellings, and shade for carparking) and financial (in terms of the values of private homes). In addition, enhancement of the city's street tree population can contribute further to removal of carbon from the atmosphere, and improve biodiversity and thereby the health of the local ecology.

An example of outstanding street-tree avenue planting exists along Hesse Street – where the trees (oaks) on either side almost meet across the road to provide an impressive cathedral-like canopy.

It is understood that an Urban Forest Strategy is being formulated for the Colac city, and that this will sit within a green planning framework to support the concept of 'A city within a botanic garden' (R. Small pers. comm.). It is assumed therefore that this study will consider opportunities to further improve and extend the areas for street-tree planting.



Plane trees in Fyans Street, looking east from Gellibrand St corner.

Opportunities to consider the street-tree population as extensions of the botanic gardens living collections exist. In considering the ‘city within a botanic garden’ concept, the urban tree forest could be considered as supporting the objectives of the living collections policy of this masterplan – perhaps at least in part. New opportunities for planting may support one of the priority living collections, thereby taking the botanic garden concept of living collections outside the fence, both literally and figuratively.

For example, given the characteristic nature of the oak (*Quercus*) collection within the CBG, and the suitability of various species of oak for Colac’s growing conditions, it is suggested that the *Quercus spp.* be considered for further planting as street trees in northern Colac. The species selection may include some of the evergreen species of North America and the Mediterranean zones.

The town square in Colac supports an impressive array of elms (primarily *Ulmus procera* and *U. X hollandica*). Further planting of elms may be considered, though the benefits should be weighed against the costs of regular treatment for protection against pests such as Elm Leaf Beetle, which is known to infest the area and causes significant unsightly defoliation and if left untreated possible death of the tree over a period of years.

Factors affecting the choice of species for selected streets will include whether it is deemed desirable to have deciduous or evergreen trees, mature growing height and canopy spread, specific soil and moisture characteristics, planting location (nature-strip or in parking zone), presence or absence of overhead services, and related maintenance issues.

Where possible, planting of new trees should be combined with adoption of ‘water sustainable urban design’ (WSUD) principles. Utilising such principles, storm water run-off should be captured within the planting and root zone of the trees, rather than being diverted through constructed drains into the stormwater system and towards the outfall. Capturing the water at the tree site has the dual benefits of providing

moisture to support the tree's growth, and also reducing the nutrient load of water in the stormwater flows, which ultimately would flow to local watercourses and the lake. Reducing the nutrient load of stormwater run-off is important in protecting the ecology of water bodies, and avoiding potentially damaging and toxic blue-green algal blooms.

Street trees planted in areas where vehicle access is likely should have protection from vehicle incursion onto the unprotected root zone, to avoid compaction of the soil and direct mechanical damage to the structural roots and the trunk of the tree.

As a matter of common sense, the mature height of trees should be considered where their canopy is likely to coincide with the clearance zone around power supply lines. In the longer term, undergrounding of cables is ideal to allow full-canopied trees to develop as avenues in the city's streets.

The more natural planting zone along Barongarook Creek could also be seen as an opportunity to link to the CBG's indigenous plant collections – providing also the benefit of habitat development with associated wildlife habitats. Additional development of the planting of the creek corridor in this way would further enhance the significant improvement works that have been carried out in recent years by various community stakeholders. The creek corridor has great potential for interpretive and educational programs.

Recommendations:

- **That the concept of considering the existing and future street tree plantings of Colac as extended plant collections of the Colac Botanic Gardens be adopted;**
- **That future street tree plantings should further build on the priority collections of the CBG, but also add diversity to the urban forest;**
- **That street tree planting treatments utilise WSUD principles, to achieve greater health for the trees and associated environmental benefits;**
- **That the street tree population be utilized for its opportunities of public education and engagement.**
- **That the Barongarook Creek corridor be further enhanced through reestablishment of local indigenous riparian vegetation, as an extension of the CBG's living collections.**



View south along Gellibrand Street, Lophostemon confertus competing with power lines for space.

Planted structure of beds

The Patrick & Wallace (1993) study recommended renovations to the planted structure of most beds within the site. The need for this type of activity arises from the maturing of older plants within the beds, lower light levels from developed tree canopies, shrubs losing vigour, and short-lived plants disappearing at the ends of their life-span. The result is that the beds lose their structure and diversity of planting, which in the context of a botanic garden, means a loss of quality. Renovating garden beds in this condition often requires judicious removal of old shrubs or individual trees, particularly those which may be of limited botanical or horticultural value. New plantings can then establish more effectively without the issues of limited or filtered light and competition from established plants.

In general terms the desirable structure for a shrub and tree bed involves taller stock towards the middle of the bed (or the rear if it is backing onto a boundary), and graduated heights down towards the front. This form of structure of the height strata allows the foliage and flower presentation to appear 'layered', and to provide a satisfactory level of amenity while also provide reasonable light levels for the development of the lower level plants in the foreground. Sparingly, occasional 'accent' plants of greater height may be incorporated closer to the viewer.

Plans for individual bed renovations should be formulated with consideration of the role of the bed in visual terms, its growing conditions (light levels, exposure to wind, competition for moisture, drainage characteristics), need for visual screening or otherwise, level of visual priority (eg. is it a high profile site near a major entry point?), and how it responds to the other landscape elements in its zone.

Bed renovations offer the opportunity to support and contribute to the development of the identified priority living plant collections within the gardens – through replacement of 'common' garden plants with species or varieties of greater interest and botanical value. Plant assessments (to establish the value of the existing individuals) and planting plans should be completed for each bed before they have any plants removed. Preferably, the new stock should be sought and be ready for replanting also, to limit the 'down time' period between bed clearance and replanting.

It is recommended that the following beds (using the labeling system established in Patrick & Wallace 1993) are progressively renovated and replanted over the coming decade, using the following priorities:

High priority

Beds D, F, I, N, Q*, S, V, W, Z, AA, AC, BB, KK, LL, NN*, PP, ZZ

(Bed QQ to be removed as a high priority, for landscape quality reasons)

Medium priority

E, F, L, T, Y, EE, GG, II, JJ, MM, SS, TT, WW

Lower priority

A, B*, C, G, H, J, K, M, O, P, R, U, X, CC, DD, FF, GG2, OO, UU, VV, XX, YY, AB

*scheduled replanting of ornamental perennial or annual displays to continue.

Removal of bed QQ is recommended. It is a relatively small circular bed planted with roses, in a prominent part of one of the more significant long views in the north-east section of the garden. Its presence acts as a visual intrusion in this view – the scale of the bed is too small for it to enhance the view, and its placement does not complement the quality of this view. The site should be reincorporated as part of the lawn.

A bed existed in past years closer to the rose arbor, and reinstatement of a bed in this area could be considered, if provision of seasonal flower colour in this northern side of the garden landscape is desired. The actual scale and form of the bed should be the subject of a detailed design to ensure its compatibility with the surrounding landscape, and appropriate scale and position. Roses on the arbour may require replacement also in the outlook period.



Bed 'QQ' in the view, looking west from near the fountain.

Recommendations:

- **Undertake staged renovation of the planted composition of beds within the CBG, on a prioritized basis as outlined above.**
- **Remove small circular bed 'QQ', re-turf area.**
- **Plan and re-establish ornamental bed closer to rose arbour.**

Turf and Lawns

The lawns are an important and integral component of the CBG landscape. They provide an essential 'clear' visual element to allow the other plantings to be best appreciated, and also perform a vital practical role for visitors' enjoyment.

The quality and composition of the turf lawns across the site is mixed. Generally there is a prevalence of cool-season annual grasses Rye (*Lolium rigidum*, *L. perenne*), Fescue (*Festuca spp.*), Winter Grass (*Poa annua*) and other related species, with some patches of warm-season grasses such as Couch (*Cynodon dactylon*), Kikuyu (*Pennisetum clandestinum*) and Buffalo Grass (*Stenotaphrum secundatum*), growing amidst the cool season species.

Warm season grasses will perform better and remain healthy and green from spring to autumn with lower irrigation requirements than the cool season grasses. As they are generally dormant in winter, a mix of cool and warm season species is recommended.

To improve the existing turf condition, introduction of greater areas of warm season grasses across the main lawns is suggested. Lawn conversion can be undertaken successfully by sprigging into existing turf during early summer. In this way, lawn resilience can be increased and water requirements reduced, without the need for more dramatic and unsightly complete renovation of turf areas. The warm season species will generally out-compete the cool season species through summer, particularly if there is limited water applied.

Recommendation:

- **In stages, introduce additional areas of warm season grasses to augment the existing turf mix, and to achieve more hardy and resilient mixed lawns for the summer months.**



Differential drying of turf types – cool season grasses drying off in early summer.

Site documentation

The existing site documentation is lacking detail, and is considerably out-of-date. Two general base plans exist. One was prepared for the Patrick & Wallace conservation plan (1993), and is included in that document. The other is undated, and is possibly more recently prepared than the other plan, but is still out-of-date and lacks layers of relevant site detail.

In order to ensure a good quality of site planning in the future, and to ensure that changes to the CBG are well designed and documented, a good detailed features survey is recommended. The survey should include layers such as paths, beds, trees (with an identifying number), collection areas, infrastructure (taps, sprinklers etc), fixed seats and other assets, buildings and other structures.

Recommendation:

- **Prepare a detailed site plan based on a site survey, including layers of information, as outlined above.**
- **Ensure that changes to the built and living landscape are incorporated into the plan, so that it remains current over time.**

LIVING PLANT COLLECTIONS PLAN

Introduction

Living plant collections are integral to the role of botanic gardens. To a great degree, they are what separates the botanic garden from general civic parkland and other green spaces.

Generally living plant collections are described as managed groups of plants, demonstrating particular themes. The collections may serve one or more of the general goals of research, conservation, education or ornamental display. The plants within the collections should be accurately identified, and labeled to allow the benefits of public education. Additional interpretive information is often also provided for visitors to extend their understanding of the collections and their significance.

Collections are commonly grouped within one area of a botanic garden, but in the case of collections of trees or large shrubs, may be spread across the site for the sake of landscape aesthetics. Sometimes it is also sensible to locate particular plants from within a collection in parts of the garden where the growing conditions are most appropriate (eg. exposure to full sun or protection in partial shade, freely draining soil or natural wet areas, etc.).

a. Collections within the Landscape

It should be noted that the living collections sit within (and form part of) a culturally significant landscape. Maintaining and enhancing the existing collections, and development of additional collections into the future should be done in ways that are sympathetic to the significant values of the landscape.

That said, it is prudent when considering the choice of species to replace an historic specimen to consider that with a changing climate, replacement with like-for-like may not be ideal. The same landscape objective may be achieved through choosing a species with a similar scale, form and texture, but better suited to the local growing conditions now and into the coming decades.

Sometimes the 'old' species may no longer be considered to be interesting from a botanical point of view. For example, in the 1860's *Pinus radiata* (Monterey Pine) was thought to be exotic and interesting... it was widely planted as a park and garden specimen, in rows and plantations, and as a feature tree. While there is still a place for *P. radiata* to be planted for various purposes generally relating to timber production, its interest as a feature in botanic gardens is very limited. The stand of *Pinus radiata* along the northern side of the Colac Botanic Garden performs a function as a windbreak, but potentially more interesting conifer species can equally well perform this role, rather than replacing like-with-like.

This Living Collections Plan is based on an assessment of the existing collections in the Colac Botanic Gardens, together with consideration of the potential for further development of collections to further enhance the garden, and provide it with points of speciality and difference from other regional botanic gardens in Victoria. The Plan sets out criteria for the development of the collections, and provides a framework for their future development. Included in this section are also Collection Management

Plans, which provide a systematic and planned approach to the future improvement of each specific collection. These are not detailed prescriptive documents, but should be seen as guiding frameworks to be updated and maintained to ensure their currency and relevance.

b. Plant Records

Plant records are essential ingredients in the management of botanic gardens. All incoming plants (known as ‘accessions’) and plantings in a botanic garden should be documented. Each plant should be allocated a unique identifying number that allows the origin, location and life of the plant to be tracked. In areas where large drifts of a single species or taxon are used (eg. a large planted drift of a particular ornamental grass) where the stock is all from one source or genotype, then a single accession number can be applied to that group of plants (rather than numbering each plant individually).

Various computer-based programs are available to facilitate the storage and manipulation of plant database information. Choice of which system to use is dependent totally on the resources available to purchase and maintain the system, and the needs of the garden’s staff in terms of extraction and use of the data. Geographic systems are very useful, to provide a basis for easy location and mapping of plants within a site. This information can then be harnessed to provide enhanced visitor information regarding living collections and plant location.

c. Interpretation

An intrinsically important aspect of developing living collections is the planning of their interpretation. Accompanying the cultural information for each collection should be complementary information about the interpretive objectives and themes, to maximize the opportunities for public education from their interaction with the collection.

d. Vision statement for the living collections of the Colac Botanic Garden:

- The living plant collections of the Colac Botanic Garden will reflect a combination of the influences of the cultural and natural heritage of the site, and its place within the geographic region.
- The collections will demonstrate diversity of plant display and aesthetic quality, while respecting the site’s heritage values.
- They will support and enhance the unique qualities of Colac Botanic Gardens, and strengthen the points of difference between this garden and other regional botanic gardens within Victoria and other state.

e. Living Collection Themes:

The following themes have been adopted by botanic gardens in Victoria under the BGANZ umbrella, and are based on those established by the Royal Botanic Gardens Melbourne in its Living Collections Plan (2008).

i. Cultural and Ornamental

A collection of plants that display ornamental, historic or social values relating to our cultural heritage.

These collections focus on the influence of past and contemporary cultures on the horticulture of Colac Botanic Gardens, and may include innovative approaches for achieving aesthetic interest with plant design. Collections in this theme may present a diverse range of species or cultivars from within specified genera, plant types (eg. perennials) or other groups.

Collection Principles:

Cultural and Ornamental collections will demonstrate a selection of the following attributes:

- Traditional or modern horticultural design styles
- Hybrids, cultivars and species grown for horticultural interest and display
- Plants that have heritage association with the Colac Botanic Gardens, and may include reintroduction of past collections and commemorative plantings
- Plants of historic importance that demonstrate original design intent
- Plants that are linked to the traditional use, belief systems, are, medical treatments etc. of a defined cultural group
- Plants that demonstrate modern horticultural responses to Colac's current and predicted climatic conditions.

ii. Geographical

A collection of plants based on a defined geographical area. In the context of Colac Botanic Gardens, the focus should be on flora of the Shire generally, especially the Otway Ranges, their foothills, and the volcanic plains.

Collection Principles:

Geographical collections will demonstrate a selection of the following attributes:

- A good representation of the endemic plants found within the region
- Plants from key vegetation communities of the Colac – Otway Ranges region
- Plants that have cultural significance within the region
- Plants from geographic regions that are homoclimatic to Colac
- Regions that are not widely represented in other botanic gardens' collections

iii. Ecological, Research & Conservation

A collection of plants that typically grow together in an ecological community defined by a particular range of environmental conditions.

In the Colac Botanic Gardens, ecological collections will focus on the habitats of the Otway Ranges, their northern foothills, and the volcanic plains, waterways and lakes.

And/or:

A collection of plants established and developed with the aim of *ex situ* conservation of plant biodiversity (ie. protection of plants out of the natural state), highlighting rare and threatened species and remnant habitats. These provide an excellent basis for education programs and increased awareness of local plant conservation priorities.

Conservation Collections in Colac Botanic Gardens will focus on plant taxa of the local region (Otway Ranges, foothills, volcanic plains, waterways and lakes). The collections should complement those of other regional botanic gardens in western Victoria.

Collection Principles:

Ecological, Research & Conservation collections will demonstrate a selection of the following attributes:

- Characteristic associations of the particular habitat
- Key species from habitats that can be grown in the Colac Botanic Gardens with the existing conditions, or minimal environmental modifications
- Associations between plants as they would be found in the particular habitats (eg. plants that naturally grow together, overstoreys and understoreys etc.), in their usual spatial density and natural floristic composition.
- Plants that are representative of the habitats of the south shore of Lake Colac (ie. the local habitats of the site itself)
- Plants existing within the Colac – Otway area that are rare or endangered
- Stock of known-provenance plants to develop a viable collection that can be utilized for propagation and reintroduction to the wild.
- Rare or threatened plants identified under the Flora and Fauna Guarantee Act

iv. Taxonomic and Evolutionary

A collection of plants that demonstrate the principles of plant classification or evolution, and that present diversity within a chosen genus or genera.

Taxonomic and evolutionary collections in Colac Botanic Garden will focus on genera that are currently well-represented within the Gardens' plantings (Acacia, Quercus and possibly Pittosporum), and species from various genera of the coniferous plants (particular Araucaria, Cupressus). The collections' development will aim to increase

the diversity of species within these genera, and the diversity of taxa for landscape use.

Collection Principles:

The Taxonomic and Evolutionary Collections will demonstrate a selection of the following attributes:

- Plants from a defined taxonomic group (eg. a genus)
- Plants demonstrating diversity and variation within a taxonomic group
- Plants that display diagnostic features of a taxonomic group
- Plants that demonstrate selected principles of plant classification or evolution
- Plants within a taxonomic group that are well-suited for growth in the local conditions (ie. providing an educational benefit to local gardeners); or show adaptations to particular environmental conditions
- A selection of species or cultivars within a group that provide reference material for plant identification

f. Plant Sources and Acquisitions

Priority for new acquisitions (accessions) for the living collections should be given to plants of known provenance (eg. wild origin location) and identity. While plants without these details may provide value in the context of the amenity of the landscape, they will be of a lesser botanical value than plants of known provenance.

With the exception of local or regional indigenous plant species that can be propagated by seed or cutting from parent plants from known locations, sourcing interesting, sometimes unusual and healthy stock with provenance details can prove to be a challenge, particularly outside the major capital city botanic gardens. For this reason it is best to develop and maintain a strong relationship with BGANZ Victoria (as the umbrella group representing botanic gardens in Victoria) and the Royal Botanic Gardens Melbourne. Often a garden such as RBG Melbourne will have surplus stock that cannot be planted within their own sites, and will generally be very willing to find homes for such plants in regional botanic gardens.

It is best to make them aware of the living collection priorities for the Colac Botanic Garden, to maximize the opportunities for benefitting from surplus stock, or sharing the benefit of a particular propagation activity. Often a major botanic garden will work in partnership with a specialist collector in order to access stock from within a chosen genus or geographic area. Regional botanic gardens can also gain benefit from these partnerships by working closely with the major botanic garden. A Memorandum of Understanding' between the Colac Botanic Garden and RBG Melbourne may be worth considering.

The prioritized order of categories for plant acquisitions (in descending order) should be:

1. Plants collected in the wild with full provenance details
2. Plants obtained from another botanic garden or accredited collector, either as progeny of plants collected in the wild, or grown without the chance of hybridization

3. Cultivars or hybrids that can be linked without doubt to their originator, and which reflect the development of plant breeding or selection within that genus
4. Species, cultivars or hybrids of known origin
5. Other plant material

Plant sources, in descending order of preference:

1. Direct collection in the wild by Colac Botanic Gardens staff, Friends of CBG or other locally reputable collector
2. Transfer from other botanic gardens or collectors
3. Purchase from a reputable nursery or collector
4. Donations from reputable sources
5. Collections from old gardens, nurseries etc.

Plants in the following categories should not be acquired:

- Plants that contravene the CITES (Control of Trade in Endangered Species) policy and regulations on plant collecting and trading (note – significant penalties exist for breaches of CITES policy and regulations)
- Prohibited imports
- Declared noxious weeds, or plants known or thought to have potential to be significant agricultural or environmental weeds

g. Collection Management:

It is imperative that the living collections be developed and maintained in a systematic way to gain the greatest benefit from the energy invested in their creation and enhancement.

Each living plant collection should have a Collection Management Plan (CMP, see **appendix ZZ**), which is kept current and updated. The CMP will include objectives, strategies and specific actions to underpin the development of each particular collection, including priorities for expansion or extension of the collection where appropriate. The CMP will also include details of any specific plant health issue or threat, and its treatment through preventative or remedial measures, together with any other relevant cultural information. The CMPs will be maintained by the Gardens' horticulturist or curator.

CMPs should be reviewed, evaluated and adjusted every two years (or sooner where necessary), to ensure that they remain useful and accurate.

h. Period of Review

This Living Collections Policy and Plan should be reviewed after 10 years from implementation, or sooner if circumstances dictate this to be necessary.

Current Living Plant Collections held within Colac Botanic Gardens:

Southern Australian <i>Acacia</i> (34 taxa)	Taxonomic & Evolutionary
<i>Quercus</i> (15 taxa)	Taxonomic & Evolutionary
<i>Cupressus</i>	Taxonomic & Evolutionary
<i>Pinus</i>	Taxonomic & Evolutionary
Otway mountain flora	Ecological/Research & Conservation
Otway foothills/heathland flora	Ecological/Research & Conservation
Bush Tucker	Cultural & Ornamental
<i>Pittosporum</i>	Cultural & Ornamental
Palms	Cultural & Ornamental

BUILT LANDSCAPE

Vehicle access – carriageway

Access by private cars and other vehicles into the Colac Botanic Gardens continues to be an issue that divides the views of the community and garden users. Supporters of the existing arrangements that allow private vehicles to be driven around the carriageway within the gardens argue that this provides valuable access to those with limited mobility, and that as the carriage loop is an historic feature of the garden, its use for vehicles should be continued.

It is interesting, though of little comfort to note that the minutes of the inaugural meeting of the Friends of the Gardens Advisory Committee on 15 May 1990 list 'future of drive in gardens' as the first item for consideration and resolution in the minutes of the meeting. Minutes of the meetings of the Friends show that discussion and motions raising concern about various aspects related to vehicle access, and recommending closure of the garden to vehicle access either in part or completely were recorded (1990, 1993, 1995, 1996, 1997, 2003 etc.). Included in the discussion is the issue of speeding motorists on the carriageway in the vicinity of the children's playground.



Carriageway within the Colac Botanic Gardens, showing wear pattern and consequent incremental widening of track surface.

A Council officers' recommendation to trial a closure of the northern section of the carriageway was put to council at a meeting in 1997, after a detailed analysis of vehicle traffic in the CBG, and surveying visitor opinions. The recommendation was not supported by Council, it appears, as a resolution to take no further action other than policing the existing regulations was agreed. While being respectful of the Council's decision at that time, it should be noted that the survey of traffic behaviour in February 1997 found that an worryingly high percentage of vehicles were recorded exceeding the speed limit (10 kmh – just above walking pace); with an average

speed for all vehicles of 21 kmh, 15% of vehicles traveling at above 30 kmh, and speeds of above 40 kmh recorded! 149 cars were recorded traveling through the CBG on one day (Sunday 23rd February 1997) within the survey period.



A private vehicle approaches an electric personal mobility vehicle on the carriageway.

There are various sound reasons for discontinuing private vehicle access. Pedestrian enjoyment of the gardens is compromised through sharing the site with vehicles, and potentially, safety of pedestrians may be threatened. Gardens are generally places of quiet contemplation and enjoyment, and the presence of vehicles circulating on the carriage loop diminishes the potential for this passive enjoyment. There are positive community health benefits from encouraging physical activity such as walking in gardens. The Victorian Government's 'Healthy Parks, Healthy People' campaign reflects the value of motivating people to enjoy public open space actively –rather than from the seat of their car.

The children's playground has developed over the past couple of decades into a popular place for family enjoyment. In the existing situation of vehicle access within the CBG, there is a heightened level of risk for children who may run out onto the carriageway from the playground. This situation is out of step with modern expectations for children's safety in playground precincts.

Dust is generated by vehicle movement, and this settles on the plants and other features within the site, reducing their level of amenity and health. Vehicles are often parked off the carriageway, in the shade of trees. This leads to compaction of the root-zone of the trees, and wear-and-tear for the turf in these areas (which are sometimes left as bare dirt as a result). There are no formal parking zones within the CBG, so parking tends to be rather adventitious.

Informal use of the verge area for parking leads to erosion of the lawn border zones, and incremental widening of the carriageway surface. As illustrated, the road surface

is perhaps up to 50% wider than it had been originally intended, through wear and tear at the margins. A traffic surface of around 5 metres width would be appropriate and adequate for this landscape.

In addition, vehicles are known to be vectors of spread of pathogens (eg. carrying fungal spores from potentially damaging plant pathogens such as Myrtle Rust or *Phytophthora* spp.), and of weed seeds (especially agricultural vehicles that can carry and shed seeds as they move).

Nevertheless, in spite of these various potential risks and concerns, it is understood that strong public opinion in support of continued vehicle access is known to exist within the Colac region. Importantly, it has been noted that allowing vehicle access provides a valuable opportunity to bring into the gardens groups or individuals with mobility or disability issues, to enjoy the gardens environment and the views across the lake. If all vehicles were prevented from entering the CBG, then these members of the community would be denied this benefit.

A reasonable approach that continues to meet the needs of this sector of the community, but that reduced the general private vehicle traffic using the CBG's carriageway would seem to be sensible. It is suggested that access continue to be allowed for vehicles displaying a permit issued by VicRoads under their Disability Parking Scheme, including types A (driver/passenger), B (passenger), C (organisations transporting people with disabilities) or D (temporary permits), or their interstate or overseas-issued equivalents.

To alleviate the landscape and tree impact of informal (permitted) vehicle parking in the margin of the carriageway, it is suggested that parking zones of defined extent be considered. Given the width of the carriageway, it should be possible to accommodate these areas without significant incursion into the adjoining ground. In other words, the vehicles may be able to park on the edge of the existing carriageway surface (pending specific locations of parking zones).

While some of the CBG's existing visitors from the community who have no personal mobility issues may not embrace the need for change to prevent access for their vehicles, it is suggested that a positive message of the benefits of undertaking a relaxing walk in the gardens may be appropriate, together with an explanation of the various reasons outlined above that support the removal of general vehicle access.

Recommendations:

- **It is recommended that only vehicles holding permits under VicRoads' Disability Parking Scheme (and CBG maintenance vehicles) are allowed to continue access to the Gardens on the carriageway, and that other private or commercial vehicles are no longer allowed access;**
- **That parking on the grass verge beside the carriageway be disallowed, but that designated parking zones be identified;**
- **That the road surface be re-established at a nominal width appropriate to the landscape (around 5 metres);**
- **That the interface between the road and the verge and garden beds be clearly delineated to avoid continuing wear and tear and compaction of**

surrounding areas;

- **That the changed arrangements for vehicle access be monitored and reviewed after two years from implementation.**



Carriageway in the vicinity of the children's play area. Note effects of informal parking close to trunks of trees.

Pedestrian access – paths

The pedestrian paths within the CBG form important elements in the design. Their layout allows the visitor to enter by one of the three main gates and meander through the site, reaching nodes of planting at path intersections. Their maintenance as practical and visual features is vitally important.

In most of the CBG, the paths are constructed from compacted gravel of varying grades, with metal edging. The metal edging is important, as it ensures that the path edges remain as delineated in the design, and that the turf interface with the path can be clean and well-defined. The gravel surface of paths tends to deteriorate and erode over time, and it is apparent that several sections of the path system are in need of renovation. Some minor paths, such as through the Otway flora collection at the eastern end of the site, are rock edged. The same principles regarding inspection and maintenance apply for these paths.

Re-gravelling is recommended, ensuring that a positive camber in the surface is achieved to avoid pooling of water on the surface. Paths should be inspected annually to establish the priority for renovation year by year.

Recommendations:

- **Implement a program of annual inspection of pedestrian paths to establish priorities for renovation.**

- **Renovate with gravel consistent with existing materials on site, achieving convex profile (camber) of surface.**



Pedestrian paths in need of renovation.



Rock-edged paths in the Otway mountain flora collection area.

Seats, picnic tables

The Patrick & Wallace report (1993) noted that there was a diversity of styles, material and construction of seats and a small number of assorted picnic tables within the CBG. Some were in quite poor condition. It was recommended that these be replaced when possible, with a standard design, perhaps consistent with the style adopted in Colac's Memorial Square.

Some of the older seats and picnic tables still remain, and their staged replacement on a priority basis as suggested above should be seen as a priority. In general, treated pine should be avoided as a material for seats or tables, as it is not consistent with the significant heritage values of the site.

All outdoor furniture within the CBG should be included in a programmed maintenance schedule, to ensure that they are kept in safe, useable condition, and that they are free from graffiti, or other damage.

New Viewing Platform

Construction of a new viewing platform on the northern side of the CBG has been completed in 2011 (opened formally on 21 February 2012). The concrete and steel structure is placed to take advantage of the spectacular views north across the foreshore and Lake Colac, and provides an access way from the lower foreshore common area up to the botanic gardens zone, via a newly built set of steps.



Construction of the new viewing platform steps, August 2011.

Opportunities for new planting exist adjacent to the constructed steps, and from the perspective of landscape context and growing conditions, extending the succulent them of *Aloe* spp., *Yucca* spp. and ground covering succulents would be appropriate. Placement of a striking individual tree such as *Aloe barbarae* (= *A. bainesii*) at the top of the steps would be appropriate and desirable.



Completed viewing platform viewed from below; faint traces of old terraces possibly seen to left of image.



Opportunity for planting adjacent to steps and platform.

*Note: the metal balustrade has now been painted dark green.

Terraces

During the early years of the Colac Botanic Gardens, a series of terraces set into the slope adjacent to (east of) the newly-constructed viewing platform provided visitors with a practical facility for seating, for viewing events and other attractions on the lower common and foreshore area. They may have been developed in conjunction with the early pavilion that existed on the lower area. Patrick & Wallace (1993) recommended their reinstatement as a priority – and indeed this should still be seen as a good opportunity to introduce tiered semi-natural seating, for viewing and enjoying various cultural events or activities, once the fire brigade training track is removed and the area becomes more suitable for public performances as a result. One could envisage live theatre, musical performances, dance, or other performance activities, with the superb visual backdrop of Lake Colac.

There are still faint visible traces, believed to be the lines of the old terraces in the slope (see image below). These are spaced at around one metre down the slope, and extend from below the viewing platform, east along the slope to near the first existing mature *Pinus radiata* (approximately 40 metres from the intersection of the new stepped access path and the main footpath that runs east-west along the bottom of the slope).

The terraces could be reestablished by excavating and reshaping the earth, and re-turfing the surfaces, to provide a practical and useable series of seating levels with low visual impact. There is a strong healthy growth of Buffalo Grass in this area – this or other robust summer grasses would be good turf types for this purpose.

Recommendation:

- **Re-establish terraced seating in the area where it once existed, for the purposes of viewing cultural events.**



Old terrace seating area – showing possible traces of terrace lines

Fire brigade training track

The presence of the fire brigade training track on the lower 'common' area was highlighted in the Patrick & Wallace report of 1993 as being an intrusive element, and its removal was recommended, with reinstatement at another location if the level of use justified this. Records of the Friends of Colac Botanic Gardens Committee meetings indicate that considerable discussion was held in April 1993, and that it was noted that the track was not being used even at that time for its intended purpose.

The fire brigade training track has remained *in situ* since that time, and has continued to be an undesirable element from a landscape perspective. The nature of the construction – bitumen track, cyclone fences and a tall moveable tower enclosed in a secure fence – is incongruous within the botanic gardens precinct. Its position on the flat area at the base of the terraced hill forms a barrier to the interface and potential use of this area for major public gatherings, artistic performances and general enjoyment. Visually, it is a negative element within what should be a high quality view from the upper part of the CBG towards Lake Colac.



View north from the new viewing platform, showing the visual intrusion of the fire brigade training track and ancillary structures.

The fire brigade training track does not appear to be under regular use – the tower structure has clearly not been actively used for some time – but it is not known what pattern of use the facility receives across the year.

It is understood that the masterplan for Central Reserve in Colac includes a new location for the fire brigade training track. Its removal from the existing site would be a very positive step towards the integration of the CBG landscape and the foreshore 'common' area. The existing cream brick storage shed adjacent to the carpark at the western side of the foreshore common area should also be removed. It is also a

visually intrusive element within the landscape.



Fire brigade training track – a physical barrier dividing the lower area from the upper zone.



Fire brigade storage shed – a visual intrusion in the landscape recommended for removal.

Recommendations:

- **Remove the fire brigade training track, its fences and ancillary structures (including the brick storage shed) at the earliest opportunity.**

- **Reinstate the area with turf, consider additional planting of a small number of trees for shade in summer.**
- **Promote the use of this area for cultural events such as outdoor theatre, music performances, community celebrations and gatherings and other public uses.**

Colac Anglers' Club building

This structure is situated near the boat-ramp carpark, at the western end of the foreshore zone. It is not a visually attractive building, being described in the Patrick & Wallace report as having 'no architectural pretensions'. Its removal would be desirable for these reasons in the longer term – but while it is in good use, its visual impact could be softened by painting it in a neutral tone, and introducing screening planting, particularly on the western, southern and eastern sides.



Colac Anglers Club building. Measures to reduce its visual intrusion are recommended.

Recommendations:

- **Paint the building with a neutral tone to soften visual impact;**
- **Introduce screening planting on the eastern, southern and western sides of the building;**
- **Consider removal of the structure in the longer-term if alternative accommodation can be identified for the Colac Anglers' Club**



Colac Anglers' Club building viewed from the south, showing need for visual screening.

Botanic Café – entry zone and external spaces

The original Curator's Cottage has been successfully converted into a café to service the needs of visitors to the CBG, and as a café venue in its own right open seven days per week. As discussed in the section on Community Engagement, it also currently accommodates the needs of the Friends of the Colac Botanic Gardens for their meetings and other gatherings.

The majority of visitors to the Botanic Café approach after parking at the northern end of Gellibrand Street, or otherwise by foot from this direction. The entry to the café for these pedestrians should therefore reflect the 'special' nature of the site as a historically and culturally significant botanic garden. Unfortunately this is currently not the case. The approach is via a narrow but serviceable brick-paved path, which enters next to a large rubbish skip*. While the café is well labeled with signs, there is little to provide information or orientation regarding the botanic gardens and its features.

(*note: the skip was not present on a subsequent visit to the site.)



Relocation of the skip to a less visually intrusive site is strongly recommended.

The timber structure to the north of the entry path is utilized by the Friends of the Colac Botanic Gardens for informal plant sales. This is a compatible and appropriate function, though the limited space would hinder significant expansion of this activity.

While the café has an attractive outdoor service area on a constructed timber deck to the north of the building, again there is nothing to indicate the nature of this site as part of a notable regional botanic garden.

The opportunity exists in such areas to present visually stunning plant displays, which could be rotated or changed throughout the year to ensure that the something exciting and interesting is always on show. In addition, this is an ideal location to provide some orientation and information regarding the CBG and its significant tree assets and other living collections.

Recommendations:

- **Relocate the rubbish skip to a site out of the general public view, and away from the main zone of public access to the Botanic Café;**
- **Provide signage or other information regarding the botanic gardens at the entry point to the café from Gellibrand Street;**
- **Consider options for visually interesting plant displays (possibly in containers or planters) on the decking area of the café;**
- **Provide information about the botanic gardens and its collections to café patrons, on tables or fixed locations within the café zone.**

Old toilet block

The 1930's decommissioned toilet block on the slope towards the western end of the site is noted as having 'excellent visual quality', and 'punctuating the slope effectively establishing a picturesque element' in Patrick & Wallace (1993). Its architecture remains intact, but sadly its visual quality has deteriorated, with extensive graffiti and the signs of misuse. Access to the building is possible from the northern side, through the original entry opening.

A case for excluding access could be made – though whether this would resolve the existing graffiti issues is unclear. Nevertheless, there is no reason to access the building for acceptable visitor activity.

Recommendations:

- **Graffiti on this building is removed or painted over;**
- **Access through the opening on the northern side of the structure is closed;**
- **Regular inspection and removal of graffiti is carried out.**



1930's toilet block – access on north side



Internal view of 1930's toilet block

ENVIRONMENTAL ISSUES

Planning for a changing climate

Climate change is a complex and challenging issue. Expert opinion continues to differ regarding the detailed effects derived from climate modeling, but there currently exists general acceptance that the climate is – and is likely to continue to – change, as a result of various factors. Broadly in Victoria, the likely effects in the 20-50 year outlook period would mean that most regional areas in western Victoria will become drier and hotter on average. Precisely how much hotter and drier depends on a range of variables, including mitigation of carbon dioxide build-up in the atmosphere.

Scenarios provided by the Victorian Government's Office of Climate Change indicate that on average across the Corangamite Region (which stretches from Ballarat to Cape Otway and includes Geelong) by 2070 the region can expect to be:

- 1.3 degrees C warmer with 6% less rain under a lower greenhouse gas emission growth scenario
- 2.4 degrees C warmer with 12% less rain under a higher greenhouse gas emission growth scenario

In summary, the greatest increases in temperature are expected in summer (with more extreme hot days), the greatest decreases in rainfall are expected in spring, and there will be fewer rainy days but increasing rainfall intensity. By 2070, the run-off into the Barwon and Moorabool Rivers and Lake Corangamite is expected to decrease by up to 50%.

While these projected changes in temperature and rainfall may not seem significant, their combined effect would mean noticeable changes at the local level. In horticultural terms, the change of a degree or two can mean that a species that is surviving but at the limit of its tolerance will no longer be viable. Plants that can survive in the historic rainfall conditions may require substantial additional irrigation to keep it alive. Changes in air temperature are harder to mitigate in horticulture. Extremely high air temperatures, such as those experienced in Victoria in 2009 (over 45 degrees C) can lead to severe scorching and death of some species.

More intense rainfall days mean reduced levels of water infiltration into the soil profile – and higher rates of runoff. So while the rainfall may be measured at a particular volume, in terms of 'effective rainfall' it may have a less beneficial result.

In terms of planning the future living landscapes of gardens, the clear message is that a priority should be placed on selecting plants that are already well-suited to growing in the local conditions, and have the ability to cope with conditions that may be hotter and drier to some extent. This is an extension of the 'homoclimatic' approach – where plants from parts of Australia or the rest of the world that have analogous growing conditions are chosen. To cater for hotter, drier conditions, the frame for assessing the homoclimatic conditions needs to be moved into the nearest biozones that exhibit these characteristics.

For example, instead of seeking plants from mid- to north California, one would examine the flora of southern California. Rather than sourcing plants from Yunnan in southern China, we would look to areas of western Asia that demonstrate conditions

closer to our model. The result of taking this more measured and planned approach (with regard to selecting plants based on their natural growing habitat) is that the plants will have the best chance of survival in the predicted warmer and drier conditions, and the resources required to keep the plants alive and healthy will be contained.

For a garden such as the Colac Botanic Gardens where much of the value of the existing site lies in its mature tree collection, clearly there is a need to ensure that as far as is practicably possible, the existing trees can survive. This may mean closer monitoring of their health and condition, timely remedial treatment for structural or health issues, monitoring of soil moisture characteristics, and if appropriate, consideration of areas of specifically higher irrigation for chosen individual trees. Despite these measures, the life-span of some of the mature trees may be shortened, so succession planning must be given a priority.

Lawn areas play a critically important role in terms of the landscape quality for this garden. Just as it is important to plan for plant selections to best suit the prevailing and expected climate conditions, so too it is sensible to consider a process for conversion of a proportion of the lawn turf to warm season grasses. These grasses will thrive in summer with a lower water requirement than cool season grasses (which currently make up the majority of the turf within the site). Warm season grasses include Kikuyu (*Pennisetum clandestinum*) and the various Couch varieties (*Cynodon dactylon*). (see section on **Turf and Lawns XXXX**)

Irrigation Management

The Gardens is currently irrigated through an in-ground watering system, with occasional manual watering by hose where needed. The supply is from the potable mains water, via sub-mains and reticulation that were installed during the period 2005-7. Generally the system is in good order.

Scheduling of irrigation (application frequency and duration in any specified area) has been guided by observations of plant condition, weather characteristics (temperature, precipitation, wind), appearance of turf, and cyclic patterns (succession of irrigated areas within the Gardens). This combination of approaches has worked reasonably well across the site – given the limitations of technology in place.

As with all sites where irrigation volumes, duration and frequency are guided by observations of symptoms above the ground, there is a degree of what might be termed 'educated guesswork'. This is not a criticism, but more intended to highlight the nature of irrigation decision making in the absence of a quantified soil moisture measurement system.

It would not be unreasonable to continue the irrigation of the Gardens in the manner that has been demonstrated over the past few years – though in the event of water restrictions, this may not be possible. If a more tailored and needs-based irrigation of the site is to be given priority (and this should be the aim in public gardens and parks to ensure that their community responsibilities are being met), then a system of soil moisture sensing would be recommended.

Such a system would provide daily and continual data on the moisture availability within the root-zone of plants within the Gardens, and would thereby inform the need for irrigation, and the volume and frequency. Through the use of such technology

alone, significant savings in water use can be achieved, together with maximizing plant health through not under- or over-watering.

The irrigation efficiency of the existing system should also be checked – to understand in detail the patterns of delivery across the site. This is a relatively simple process involving placement of catch-cans within specified distances in the radius of the sprinkler's trajectory. It is known, for example, that impact sprinklers have a fairly uneven distribution of water in their total radius, compared to other forms of turf sprays or other sprinkler heads. An understanding of the irrigation efficiency is very valuable in ensuring that irrigation timing and duration are achieving the best effect for plant health within their radius.

Continuing the regular applications of a good quality organic mulch to all garden beds will ensure that moisture lost from the soil by evaporation is kept to a minimum. Application of an organic mulch layer within the canopy zone of selected trees should be considered where a tree may be showing signs of drought stress, compacted soils or other local issues.

Planting of new trees or other significant new planted areas should be undertaken during the period from autumn to spring – avoiding planting new material during the dry and hot months of summer. New trees may require hand irrigation during the first couple of summer seasons to ensure that they are well established, and that the investment in planting is not wasted.

Turf should be augmented by additional warm-season grass species introduction – see section on Lawn Composition.

Water Supply

While it is understood that the existing water supply is from potable mains water, opportunities for the use of recycled water may arise in the future. Use of recycled water for irrigation can have many benefits, particularly in regard to availability (in times of restriction to potable water supply), and in cost. Weighed up against these factors however is the cost of installation of reticulation to keep the recycled supply separate from the domestic supply on site (as required in the café, depot and public amenities), and the water quality characteristics of recycled water.

If a recycled water supply is under consideration, a vital initial step is to undertake testing of various chemical and physical factors relating to the water, and to assess the results alongside the acceptable parameters for irrigation supply. Often recycled water (depending on its class rating) will have unacceptably high levels of phosphates, nitrates or salts for healthy plant growth. Salts can be particularly damaging for a garden, and recovery of a site from application of saline irrigation over a period of time can be very difficult.

A table presenting acceptable water quality parameters for irrigation (as defined by the Royal Botanic Gardens Melbourne) is attached in Appendix F.

Recommendations:

- **Consider existing and future predicted climate when choosing species**

for planting within CBG, seek taxa from homoclimatic zones;

- **Monitor the performance and health of existing valuable plantings (particularly trees) and if necessary, apply additional irrigation in dry summer periods to ensure the health and survival of the individual trees;**
- **Consider the installation of technology to better understand the soil moisture characteristics of the site; and utilize such tools to assist in the management of volume and frequency of irrigation for best plant health outcomes;**
- **Ensure that the irrigation system is regularly checked for optimum operation and efficiency;**
- **Time new planting for autumn – spring; avoid new plantings through summer;**
- **Continue to apply organic mulches to garden beds to reduce evaporation of moisture from the soil;**
- **If recycled water is being considered for irrigation use, ensure that its physical and chemical properties meet quality criteria for soil and plant health, and public health.**



Colac Botanic Gardens, December 2011.

WEED MANAGEMENT

Over recent years, the issue of potential weed risk from plants introduced through botanic gardens (or other gardens) has become prominent. A number of common environmental weeds were introduced as desirable garden plants, only to 'escape' to natural environments and cause considerable problems. The costs of weed control across Australia each year are very significant, and the loss of habitat and threats to vulnerable native species from weed infestation are also of great concern.

Major botanic gardens around Australia (led by the RBG Melbourne) have participated in the formulation of policies and procedures to address the weed risk issue. In 2004, the Council of Heads of Australian Botanic Gardens (CHABG) established an Australian Botanic Gardens Weed Network to further develop processes for weed risk assessment, and most of the major Australian botanic gardens, zoos and allied agencies are now members of this network.

Arising from these initiatives, an excellent and detailed paper on the issue of weeds, their impacts and risks can be found in:

Spencer, R (2006). Garden plants as environmental and agricultural weeds. Resources and information pack; with emphasis on Victoria. Royal Botanic Gardens Melbourne, Weed Working Group.

The managers of botanic gardens around Australia, including large city-based gardens and regional botanic gardens are now mindful of the need to take a more watchful and thoughtful approach to introducing plants to horticulture, to avoid further introduction of new potential weeds, and to ensure that the spread of existing ornamental plant weeds is kept to the minimum.

Weed Risk Assessment

The following summarized information and tables have been modeled on those in Spencer (2006).

RISK = (IMPACTS & POTENTIAL DISTRIBUTION) X INVASIVENESS

Plants can be placed into broad risk categories, according to an assessment of their level of comparative invasiveness, and the impacts and potential distribution of their spread.

The risk matrix

INVASIVENESS	IMPACTS & POTENTIAL DISTRIBUTION		
	LOW	MEDIUM	HIGH
LOW	LL	LM	LH
MEDIUM	ML	MM	MH
HIGH	HL	HM	HH

Invasiveness can be judged by considering the plant's natural characteristics for spread – such as production of propagules, seed quantity and dispersal, underground structures (eg. stolons), tolerance of a broad range of growing conditions etc., and any known weed issues involving the particular species in comparable climatic and growing conditions.

In considering whether to introduce plants to a garden, and how to manage plants that are already growing in the gardens (which may have been growing there for some time), the 'garden landscape and collection values' factor may also be considered, as below:

Weed Risk Management Matrix

WEED RISK ASSESSMENT	GARDEN LANDSCAPE AND COLLECTION VALUES		
	Low	Medium	High
LOW RISK	grow	grow	grow
MEDIUM RISK	Do not grow; if already present, develop management strategy for eventual removal	Grow, but implement management procedures to monitor plant	Grow, but implement management procedures to monitor plant
HIGH RISK	DO NOT GROW If already present, develop strategy for eventual removal	DO NOT GROW If already present, develop strategy for eventual removal	DO NOT GROW If already present, develop strategy for eventual removal. Seek advice from Weed Management Council for possible exemption in extreme cases

It is recommended that new introductions of plants to the Colac Botanic Gardens are assessed for their potential for weediness, before they are added to the collections. Vigilance should be maintained regarding the existing plant collections and general planting, to be aware of any plants or groups of plants that may start to spread as weeds within the CBG or its surrounding lands. Such potential weediness should be addressed promptly with well-reasoned decisions, to avoid longer-term issues.

Further potential exists to support the Shire of Colac Otway's public education on environmental weeds, through on-site interpretation and printed material.

Recommendations:

- **Ensure that new plant introductions are assessed for their weed risk potential;**
- **Avoid introducing plants that present a significant risk of ‘escape’ and uncontrollable colonization in the CBG and in surrounding landscapes;**
- **Avoid propagation and distribution of plants that are known to have significant weed risk potential;**
- **Utilise the management of weed risk as a public educational tool, to improve community understanding of environmental weed issues.**

BIOSECURITY MANAGEMENT

Biosecurity is broadly defined as the protection of a site or area against threats from pathogens (harmful diseases) and pests. Pathogens may be in the form of fungal infections (eg. Dutch Elm Disease and various *Phytophthora* spp.), bacteria (eg. fireblight) or viruses (eg. potato virus). Pests are often insects, and these may cause direct damage (eg. Elm Leaf Beetle), or be vectors for pathogens (eg. Elm Bark Beetle – the vector for Dutch Elm Disease).

Publicly accessible gardens face various threats from introduction of various pests and pathogens on clothing, footwear, vehicles, animals, birds and plant material. One of the significant current threats is Myrtle Rust (*Uredo rangeli*), a fungal pathogen which appeared in Australia for the first time in NSW in 2010. It is spreading both north and south, and has recently been detected on susceptible plants in Victoria (see <http://www.dpi.vic.gov.au/forestry/pests-diseases-weeds/diseases/myrtle-rust>). In Australia, around 100 Myrtaceous species have been identified hosts for the disease, including Eucalyptus and Callistemon. A specific local action plan to deal with any outbreak of Myrtle Rust (consistent with DPI protocols) is recommended.

Generally, adoption of Integrated Pest Management (IPM) principles is recommended. IPM involves implementing a range of related strategies to minimize the risk of harmful incursions, and to formulate treatments that are environmentally less harmful than utilizing chemical controls alone. For example, reducing the numbers of a particular host plant of a serious insect pest, using biological controls such as the introduction of specific predatory insects, timing irrigation to minimize the conditions suitable for fungal infection and growth, formulating standards for plant health of material introduced to the site, hygienic disposal of diseased material to minimize the risk of disease spread etc.

Tools used for pruning, digging or other on-site operations involving cutting plant material or excavation of soil should be thoroughly cleaned between activities, or (as practical) before movement from one part of the site to another. Digging equipment should be washed down with a suitable biocide to reduce the risk of spread of soil-borne pathogens from zone to zone within the site. Machinery introduced to the Gardens that has been in use elsewhere within the region should be cleaned of any soil and plant debris before they enter the site, as these can carry pathogens and weed seeds.

Contractors' specifications should include a requirement for machinery to be clean of

soil or plant debris before entering the site to commence operations. If appropriate, the Gardens curator or gardens staff may need to check the condition of machinery.

Just as for weed plant management, vigilance is extremely important to ensure that the symptoms of any new pathogen or plant pest introduction are noticed early, and the appropriate controls are put in place. Liaison with the State Government's Plant Standards Branch of Biosecurity Victoria (Dept of Primary Industries) is also important, in the event of a damaging outbreak.

Where the circumstances dictate, it may be necessary to close the site to vehicle access, in order to control risk of pathogen introduction. Such contingencies may present a valuable opportunity for public education and awareness raising (regarding the particular issue and the appropriate control measures).

Recommendations:

- **Where practical and feasible, adopt the principles and practices of Integrated Pest Management (IPM) for the control of biological pests and diseases;**
- **Establish hygiene protocols for garden tools and equipment to reduce the spread of soil and plant-borne vectors and pathogens;**
- **Ensure that contractors' vehicles and equipment are free of soil, plant material and seeds before they enter the site;**
- **Maintain vigilance within the CBG to ensure early detection of any pathogen or pest incursion;**
- **Prepare specific action plans to respond to any infection from specific pathogens such as Myrtle Rust.**

COMMUNITY ENGAGEMENT

Friends of the Colac Botanic Gardens

a. Background

The Friends of the Colac Botanic Gardens ('the Friends') was formed in 1990 (first meeting May 15, 1990). In August 1993 it was formally appointed as an Advisory Committee to the (then) Colac Otway Shire Council.

While the group's membership in number hasn't necessarily been high, it has over the years since establishment played an important role as a conduit for community representation, in partnership with the Shire of Colac Otway. The Friends have had an active involvement in support of the CBG through various activities such as plant sales, hosting visits to the site, providing guided walks, day-trips to other botanic gardens, and on-site activities for the broader community. An important role of the Friends is advocacy for the CBG's protection, future planning and appropriate development and enhancement.

There is no doubt that a strong and active Friends Group is a valuable asset for a public botanic garden. The range of support and promotional activities undertaken by the Friends provide significant benefit for the CBG, both in real terms, and as an avenue for increasing the community's ownership and engagement with the Gardens.

The Friends provide a readily accessible sounding board for management decisions relating to the CBG, and if appropriately engaged in planning discussions and decision-making, can provide the strongest advocacy for the Gardens' future development and growth.



The Friends' plant sales area, adjacent to the Botanic Café.

A small plant sales area is located adjacent to the Botanic Café, and visitors can make payment for purchases (very much an honesty system) at the counter in the café.

The records of the Friends' committee meetings reveal several recurrent issues of concern, including vehicle access to the CBG which has been mentioned as a concern frequently from 1990 onwards, that the fire training track should be removed, that the site's planning and curation should be given focus (leading to production of the Patrick & Wallace report of 1993, and this update), that plant labeling should be given priority, site security and plant selection issues, among many others.

b. Friends' facilities

The Committee of the Friends group currently utilizes a room within the Café (old curator's residence) for meetings, on the basis of bookings. While the meeting room to some degree meets the needs of the group for meeting space, it falls short of being a dedicated space with secure facilities and storage space for the Friends. Commonly, a support group such as the Friends within a regional public botanic garden should be provided with a dedicated space for their non-public activities. Examples of such facilities can be seen at Geelong Botanic Garden, Bendigo Botanic Garden (White Hills), Australian Inland Botanic Garden (near Mildura), and Ballarat Botanical Gardens.

At this stage, several clear opportunities exist to meet the future needs of the Friends group. The lowest cost option is to provide a continuing exclusive use of the meeting room of the café, so that resources such as the Friends' library collection, records, photographs, notes and other items can be safely stored and easily accessed as needed. Meetings, both formal and informal can then also be held without the need for a pre-booking process. It is understood however that maintaining flexible use of the meeting room is important for the viability and business plan for the Café, and that therefore excising the meeting room from the café would not be a favored option.

A second option is to formalize shared access to one of the other existing buildings in the precinct – such as the Angling Club building. This building sits adjacent to the Gardens on the foreshore at the north-east end of the site. While being reasonably conveniently located, the nature of shared access and use of a facility such as this can have a range of issues. The Angling Club has not been approached in the course of this study to canvass options for sharing their club building – if that is the preferred option for the future than a separate process of discussion and negotiation of shared use would need to be undertaken. It is understood however that while the building has had limited use over the past few years because of the lack of fishing activity in the lake in its drought-induced condition, now that it is reasonably well-filled again, fishing activity is likely to increase. Use of the Angling Club building will therefore increase also, and shared access may not therefore be the best option.

A third option, and the one with the greatest potential benefit over the longer-term, is to construct a new purpose-built facility for the use of the Friends within the general precinct. Given the culturally and historically significant nature of the Gardens landscape itself, and the unacceptability of alienation of the gardens landscape for

the purposes of such a new construction, the only realistic possibility for consideration of construction or installation of a new building would be outside the garden in the surrounding land. In principle, a footprint of public land in the existing informal parking zone immediately west of the CBG has been suggested as a location. This would have the advantages of being accessible to public and community groups, conveniently located close to the café and the CBG entrances, and easily serviced.



Informal parking zone outside western end of Colac Botanic Gardens – a potential area for construction of a Friends’ facility.

If this option is preferred, a more detailed process of planning and design will need to be undertaken, to address questions of function and scale of building, services, access, operational requirements and so forth.

c. Outlook

In order to gain the most benefit from the existence of an active Friends group, the Gardens’ management needs to ensure that there is a commitment to continuing to engage the Friends in discussions relating to the current and future development of the site and its living and built fabric.

Considerable potential exists for the Friends to take a stronger role in engaging the local community, particularly through the on-site delivery or facilitation of education programs for the local schools. Botanic gardens can play a very positive role in the schools’ curriculum delivery, and the site and its plants can be utilized as resources for the teaching of a wide array of subjects.

A good model for the development and delivery of education programs for local and regional schools can be found at the Geelong Botanic Garden, where building on some years of voluntary work, an Education Officer is now employed under the auspices of the Friends of Geelong Botanic Garden for this purpose (see <http://www.friendsgbg.org.au/education.php>). The GBG set-up provides a very

useful learning model for future thinking regarding the Colac Botanic Gardens' educative potential. The school education programs compliment the Victorian Government's ResourceSmart Schools (AuSSI Vic) checklist for the Biodiversity Module, and support the Victorian Essential Learning Standards (VELS) and Principles of Learning and Teaching (POLTs). The programs are coordinated by a qualified teacher/horticulturist, assisted by experienced sessional teachers who have completed "Working with Children" checks.

There is no reason why the same model could not be developed and applied within the Colac Botanic Garden, to service the needs and engage the school communities of the Colac regional schools. In addition to providing the obvious benefits in terms of the teaching frameworks outlined above, this approach also assists in developing a sense of value and engagement in the botanic garden among the younger sections of the community. Such a generational investment for the future supporters of the CBG cannot be underestimated.

Other activities that are (or can be) undertaken by the Friends to provide significant benefits for gardens visitors generally include guided walks, (with expert insights regarding the history and botanical interest of the site), special events to bring the community into the garden (eg. Easter egg hunts, Christmas celebrations, Wattle Day, harvest festivals, etc.).

Recommendation:

- **That the option of construction of a purpose-built structure in the precinct to the west of the CBG be investigated, and if agreed, that planning and fundraising processes be undertaken as appropriate.**
- **That models for schools education programs and other public engagement currently being successfully delivered at kindred botanic gardens organisations be investigated, and a specific plan be developed in consultation with key local stakeholders.**

Site and Collection Interpretation

Currently the site is interpreted to some degree through the presence of some main information and orientation signs, plant labels and a small number of plant collection interpretive signs.

Interpretive information is important for botanic gardens, because it assists visitors to understand the special nature and purpose of the site, and to learn about features such as plant collections, conservation projects, cultural heritage and significant features.

a. Main information and orientation signs



Main information sign at entry precinct.

The main information and orientation signs provide a good map and layout of the garden, and some basic information about the site's facilities and a selection of regulations. Unfortunately, at present they don't convey much of the special nature of the botanic gardens, its cultural heritage or living plant collections. This in turn contributes to the public perception of the place, and the possibly limited understanding of its role and significance as a botanic garden.

It is suggested that over time these signs might be augmented or improved to include such information. Such information could also be available in some form

b. Plant labels

The plant labels within CBG are a mixture of the anodized aluminium plates (photographically-printed 'Gedakop' system) sourced from the Royal Botanic Gardens Melbourne in the 1980's and 1990's (the system ceased to be used there in the mid-1990's), and engraved metal labels, sourced from the Friends of Geelong

Botanic Gardens.



Aluminum plate plant label – Gedakop system

Plant labeling is a key component of a good botanic garden – both for the public benefit of being able to identify the specimens within the site when visiting, and also for the maintenance of good accurate plant records for the garden’s curator or manager. It is essential that good records are kept of stock accessioned and planted out – and that the material can be re-found, with its identity and details quickly and easily able to be accessed.

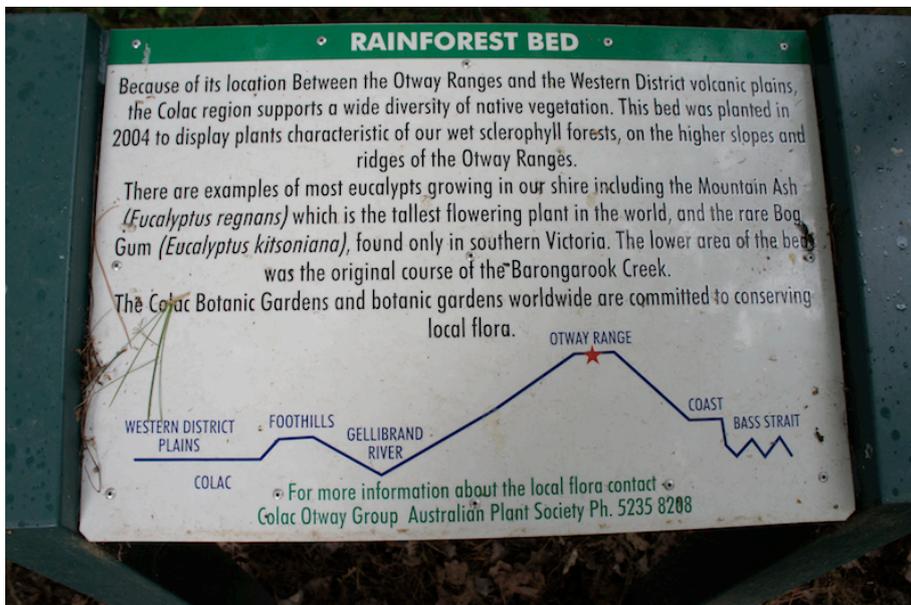
A good, durable, cost-effective and readily available plant labeling system for the CBG needs to be identified, to ensure that the plant-labeling program can be reasonably serviced into the future. Plant labeling is a role to which that the Friends group may well be able to helpfully contribute. This function is being very usefully supported by Friends groups in other regional botanic gardens. It may be that the existing arrangement of supply from the Friends of Geelong Botanic Garden may be suitable for the medium term, but equally a more locally-based production system would have benefits of supply and replacement at shorter notice.



Engraved metal labels currently in use, sourced from Geelong Botanic Gardens.

c. Plant collection interpretive signs

Apart from plant labels, other interpretive signage within the site has a variable appearance, level of detail, construction and material. For best results over time, it is recommended that a 'house style' for interpretive signage be adopted. The signs should have consistent style, font (size and type), colour and finish. The information should be pitched at a reasonably consistent level. It should aim to provide perhaps more than one level of information, so that there is value for the casual 'skimmer', and also for the person seeking a greater level of information.



Recent interpretive sign – Rainforest Bed.



Recent interpretive sign – Sensory Garden.

Recommendations:

- **That the main entry information and orientation signs be augmented or replaced over time, with inclusion of specific information about the cultural and botanical significance of the site, and its living plant collections;**
- **That engraved metal plant labels continue to be sourced from the Geelong Botanic Gardens for the foreseeable future;**
- **That options for a locally-based plant label production system be investigated, as an alternative to the current source of supply for the longer term;**
- **That a style guide for interpretive signs within the CBG be commissioned and adopted to achieve a more consistent appearance.**

Internet

The CBG has a very low profile and presence within the Shire of Colac Otway's internet pages. Indeed it is hard to locate a reference to the CBG on the shire's internet site, let alone a good level of tourist information, or interpretive or educative detail. A Google® search brings up a set of references from more general sites such as the ANBG register of botanic gardens, the National Trust's garden register, ABC's Gardening Australia television program etc. There is however a dearth of good detailed and relevant information about the site going through the local shire channels. The internet-based potential is therefore still relatively untapped. This situation should be remedied as a high priority.

Recommendation:

- **That information regarding the Colac Botanic Gardens be easily located within the Shire's website;**
- **That the information (at the least) includes location, summary of history, cultural importance, living collections and details of the Friends of CBG.**

APPENDIX A: Collection Management Plans

COLAC BOTANIC GARDENS - COLLECTION MANAGEMENT PLAN

Collection Name: Southern Australian Acacias

Location within site

Collection category: (as per Living Plant Collections Policy and Plan)

Taxonomic & Evolutionary

Objectives of collection:

1. Display a selection of species of Acacia from south-eastern Australia to show diversity within the genus.
2. Display Acacia spp. that perform well in local growing conditions
3. Demonstrate diversity of growth form, flowering display and timing

Interpretation objectives:

(broad messages to be interpreted from collection)

1. Acacia is one of Australia's iconic genera, with over 750 species across the country.
2. Acacias have are very well adapted to our varied climate and growing conditions, including adaptations for species regeneration after fire.
3. Selected Acacia spp. have great horticultural potential for the home gardener, and are easy to grow.

Current plant list:

34 taxa on gardens list – good representation of common and some less common species. Some augmentation of the collection would be beneficial – particularly to get a longer duration of flowering display with CBG.

Species as at Sept 2011:

Acacia acinacea
A. baileyana
A. calamifolia
A. cardiophylla
A. cognata
A. cognata 'Lime Magic'
A. cultriformis
A. dealbata
A. decurrens
A. elata
A. falciformis
A. floribunda

A. glaucoptera
A. howittii
A. implexa
A. iteaphylla
A. leprosa 'Scarlet Blaze'
A. longifolia
A. mucronata
A. mearnsii
A. melanoxylon
A. myrtifolia
A. myrtifolia prostrate form
A. paradoxa
A. pendula
A. podalyriifolia
A. pravissima
A. pycnantha
A. retinodes
A. saligna
A. sophorae
A. stricta
A. suaveolens
A. verniciflua
A. verticillata

Priorities for collection development:

(genera, taxa, plant type, collecting zone, rare & threatened material etc.)

Greatest scope for low to tall shrub layer within CBG (limited opportunities for planting specimen trees; continue to disperse the collection through the site, rather than grouping many acacias together in one bed (unless to show contrast between two types or growth forms).

Some possible additions:

Acacia adunca
A. alata
A. aneura
A. beckleri
A. boormanii
A. buxifolia
A. deanei subsp. *paucijuga*
A. doratoxylon
A. flexifolia
A. genistifolia
A. glandulicarpa
A. gunnii
A. hakeoides
A. kettlewelliae
A. lanigera
A. montana
A. obliquinervia
A. oxycedrus
A. riceana
A. rigens

A. sclerophylla
A. siculiformis
A. terminalis

Brief history of collection:

Collection has developed over a long period, prominent specimen of *Acacia falciformis* was an early planting. Many of the species are relatively recent additions – post 1990.

Horticultural management notes:

Fertilising/nutrition	Little required. Local soils are quite fertile enough to support strong growth of most Acacias.
Pest or disease issues & treatment	Some species prone to infestation from the larvae of various moths, and wasp galls. Galls should be manually removed if possible, and destroyed.
Propagation	Generally propagation by seed most effective; some seed requires scarification, soaking or heat treatment (check specific requirements); Cutting propagation effective for some taxa – but seed easier.
Cultivation	Quick growth for most species, occasionally requiring support up to 1m height.
Pruning	Formative pruning of young stock important – removing weak branching, co-dominant stems etc.

Reference material

(eg. literature, people, organisations, websites etc.)

Australian Plants Society (formerly SGAP)
BGANZ (Botanic Gardens Australia & New Zealand)
Dept. of Sustainability & Environment (DSE)
(add)

Collection Management Plan reviewed by:.....

Date of review: Next review recommended:.....

COLAC BOTANIC GARDENS - COLLECTION MANAGEMENT PLAN

Collection Name: *Quercus* (oaks)

Location within site Scattered, many in avenues

Collection category: (as per Living Plant Collections Policy and Plan)

Taxonomic & Evolutionary

Objectives of collection:

1. Display of species of *Quercus* with historic associations with Colac Botanic Garden, and to continue to form a significant basis of the tree structure of the site.
2. Display of species of *Quercus* that are well-suited for Colac's climate and growing conditions
3. Display of species from western USA, northern Africa and Mediterranean zone, to show adaptations to climatic conditions.

Interpretation objectives:

(broad messages to be interpreted from collection)

1. Oaks were planted very early in Colac's history, and form part of the historic fabric of CBG and Colac's living landscape
2. There are various species that are well-suited to growing in the local conditions, many are drought tolerant, particularly some evergreen species from western USA, northern Africa and the Mediterranean region.
3. There is great diversity in the genus *Quercus*.

Current plant list:

(assessment of gap)

Several taxa well represented (particularly in avenues) such as *Q. canariensis*, *Q. robur*. Avenue plantings should continue to be of matching species. Reasonable diversity of taxa – 15 spp or hybrids. Potential for further increasing of representation within genus.

Species list as at Sept 2011:

Quercus acutissima
Q. canariensis
Q. canariensis X *Q. robur*
Q. castaneifolia
Q. cerris
Q. coccinea
Q. dentata
Q. ilex
Q. palustris

Q. phellos
Q. robur
Q. robur 'Fastigiata'
Q. skottsytana
Q. suber
Q. sp.

Priorities for collection development:

(genera, taxa, plant type, collecting zone, rare & threatened material etc.)

Quercus species from northern Africa, Mediterranean region and western USA.
Succession stock for any mature single-planting trees.
Consider significant views (keep open) and areas that need some protection (ie. use layering of trees for shelter – windbreak).

Suggestions for new accessions for collection (not exclusive):

North America:

Quercus douglasii
Q. durata
Q. fusiformis
Q. gambelii
Q. laurifolia
Q. lobata
Q. muehlenbergii
Q. agrifolia
Q. virginiana
Q. emoryi
Q. wislizenii
Q. macrocarpa

Europe/Africa:

Quercus faginea
Q. petraea
Q. leucotricophora
Q. lusitanica
Q. macranthera
Q. coccifera
Q. libani

Brief history of collection:

Developed from earliest plantings within the current site in 1800's. Oak avenue around the carriageway is a prominent feature of the site.

Horticultural management notes:

Fertilising/nutrition	Little required – local soils are generally fertile enough for healthy growth of most oak species. Where desired, use organic fertilizer in spring to assist tree growth.
Pest or disease issues & treatment	Browsing by possums possibly the most significant existing threat – minimize where necessary by installing acetate trunk guards to prevent access to the tree from the ground (only effective if the canopy can be separated from other trees- not always practical). Elm-leaf miner can infest summer foliage – generally only cosmetic damage. Monitor for appearance of any significant pathogens such as Sudden Oak Death (<i>Phytophthora ramorum</i>) – not known currently in Australia.
Propagation	Generally by seed, preferably from wild-collected source (but consider cultivated stock as parent if cross-pollination and hybridization is not likely). Consider parent stock from old heritage specimens in botanic gardens or other historic planted landscapes.
Cultivation	Ensure that root zone is not compacted by vehicular traffic or other machinery, avoid waterlogging or extreme desiccation of soil, mulch around young trees and if feasible mature trees.
Pruning	Formative pruning when young to avoid co-dominance or other structural weaknesses. Visually check trunk, major limbs and canopy for signs of weakness, cracking or breakage, and implement remedial pruning where needed.

Reference material

(eg. literature, people, organisations, websites etc.)

Heritage Victoria citation
Patrick & Wallace report (1993)
BGANZ
Royal Botanic Gardens Melbourne
(add)

Collection Management Plan reviewed by:.....

Date of review: Next review recommended:.....

COLAC BOTANIC GARDENS - COLLECTION MANAGEMENT PLAN

Collection Name: Cupressus

Location within site

Collection category: (as per Living Plant Collections Policy and Plan)

Taxonomic & Evolutionary

Objectives of collection:

1. Display a representative collection of *Cupressus* demonstrating the diversity within the genus
2. Develop a collection that demonstrates the suitability and landscape use of selected *Cupressus* species for the local growing conditions.
3. Utilise the collection to contribute to the significant landscape aesthetic of the CBG, particularly as framework feature trees.

Interpretation objectives:

(broad messages to be interpreted from collection)

1. While selected *Cupressus* species and cultivars form part of the cultural and rural landscapes of the region, there is far greater diversity within the genus.
2. *Cupressus* have been key feature trees within the historic CBG landscape
3. There are many species of *Cupressus* that are well suited to the current and future growing conditions of the region.
4. Many *Cupressus* show features and characteristics that show that they are well-adapted to hot, dry summers and harsh conditions.

Current plant list:

Cupressus arizonica
C. forbesii
C. funebris
C. glabra
C. lusitanica
C. lusitanica X *C. torulosa*
C. macrocarpa
C. macrocarpa 'Horizontalis Aurea'
C. macrocarpa 'Aurea Saligna'
C. sempervirens
C. sempervirens 'Swane's Golden'
C. torulosa

Priorities for collection development:

(genera, taxa, plant type, collecting zone, rare & threatened material etc.)

Cupressus species from homoclimatic zones of the world – such as western North America, parts of central Asia, Mediterranean zones.

Consider new accessions such as:

Cupressus atlantica

C. macnabiana

C. lusitanica var. *benthamii*

C. goveniana var. *goveniana*

C. dupreziana

And others

Brief history of collection:

Most likely developed from late 1800's, as *Cupressus macrocarpa* became widely planted in region. Additional planting of more interesting species in early 1900's, augmented in 1990's and early 2000's.

Horticultural management notes:

Fertilising/nutrition	Generally require little additional fertilizing or other soil additives.
Pest or disease issues & treatment	Some members of Cupressus (eg. <i>C. macrocarpa</i> , <i>C. sempervirens</i> , <i>C. arizonica</i>) susceptible to Cypress Canker, caused by either <i>Seiridium cardinale</i> , or <i>Botryosphaeria</i> sp. (fungal pathogens). Treatment (if caught early) using Phosphoric acid or Copper oxychloride. Cupressus spp. also susceptible to <i>Phytophthora</i> spp. (eg. <i>P. cinnamomi</i>)
Propagation	Propagation by seed (preferably wild-collected, known origin), or by cutting from known provenance stock.
Cultivation	Ensure that root zone is not compacted by vehicular traffic or other machinery, avoid waterlogging or extreme desiccation of soil, mulch around young trees and if feasible mature trees.

Reference material

(eg. literature, people, organisations, websites etc.)

Heritage Victoria citation
Patrick & Wallace report (1993)
BGANZ
Royal Botanic Gardens Melbourne
(add)

Collection Management Plan reviewed by:.....

Date of review: Next review recommended:.....

COLAC BOTANIC GARDENS - COLLECTION MANAGEMENT PLAN

Collection Name: *Pinus*

Location within site Mostly on northern terraces, and scattered

Collection category: (as per Living Plant Collections Policy and Plan)

Taxonomic & Evolutionary

Objectives of collection:

1. Display a collection of *Pinus* species from homoclimatic parts of the world
2. Develop a collection that demonstrates diversity within the genus *Pinus*, and the environmental adaptations of the species.
3. Develop and maintain the collection to enhance the strong structural tree framework and heritage values of CBG.

Interpretation objectives:

(broad messages to be interpreted from collection)

1. *Pinus radiata* was introduced to Victorian landscapes in the 1860's but there is far greater diversity in the *Pinus* genus.
2. *Pinus radiata* is the most widely-planted pine in the world, has been an important economic timber tree in Victoria, and widely used in rural planting. Its natural distribution is very limited to only three wild stands in coastal California.
3. Species within this genus have developed particular adaptations in response to environmental conditions.

Current plant list:

List of current species of *Pinus* at CBG:

Pinus canariensis
P. coulteri
P. halepensis
P. monticola
P. patula
P. pinaster
P. pinea
P. ponderosa
P. radiata
P. thunbergii
P. wallichiana

Priorities for collection development:

(genera, taxa, plant type, collecting zone, rare & threatened material etc.)

Some suggestions for additions to collection, as the opportunity arises:

Pinus mugo
P. strobus
P. sylvestris
P. roxburghii
P. contorta
P. sabiniana
P. nigra (var. *italica*)
P. resinosa
P. banksiana
P. aristata

Brief history of collection:

Pinus planted in CBG from earliest years – notably as windbreaks along the terraces area between ‘upper’ garden and the foreshore of Lake Colac. A number of original plantings of *P. radiata* survive in this area, though most are towards the end of their functional lifespan. In recent years, new stock has been planted in some gaps (following removals), and also in the garden proper.

Horticultural management notes:

Fertilising/nutrition	No particular needs – soils should be generally neutral to slightly acid pH, well drained. Occasional application of organic fertilizer will deliver stronger, quicker growth.
Pest or disease issues & treatment	Most pines susceptible to specific fungal pathogens, insect infestation (eg. Sirex Wasp).
Propagation	By seed – young growth is generally quite fast, except for some species from arid or semi-arid zones which are slow to establish (eg. <i>P. coulteri</i>)
Cultivation	Ensure that root zone is not compacted by vehicular traffic or other machinery, avoid waterlogging or extreme desiccation of soil, mulch around young trees and if feasible mature trees.

Pruning	Remove co-dominant shoots when young, check for good structure as trees develop, remove cracked or broken branches.

Reference material

(eg. literature, people, organisations, websites etc.)

Heritage Victoria citation
 Patrick & Wallace report (1993)
 BGANZ
 Royal Botanic Gardens Melbourne
 (add)

Collection Management Plan reviewed by:.....

Date of review: Next review recommended:.....

COLAC BOTANIC GARDENS - COLLECTION MANAGEMENT PLAN

Collection Name: Otway Ranges Mountain Flora

Location within site .Eastern end of CBG, b/n depot area and playground

Collection category: (as per Living Plant Collections Policy and Plan)

Ecological, Research & Conservation

Objectives of collection:

1. Display a collection of characteristic species of the Otway Ranges montane forests
2. Demonstrate plant associations commonly found in habitats of the Otway Ranges
3. Display the range of Otway Ranges montane species within selected genera (eg. *Eucalyptus*).

Interpretation objectives:

(broad messages to be interpreted from collection)

1. The Otway Ranges supports a diverse ranges of species within various habitats.
2. The local indigenous flora is rich and interesting.
3. The growth form and habit of some species varies greatly according to the conditions that it grows in, and genetic variation within the species (eg. *Acacia melanoxylon*).
4. Aborigines of who inhabited the Otway Ranges before European settlement of the area used various plants for food and in day-to-day life.

Current status vs. objectives:

(assessment of gap)

Existing collection area at the eastern end of the CBG is already well-established and thickly planted. Some additional species, particularly low-level ground covers and low shrubs could be added, in suitable areas of microclimate and light level. Interpretive information has been installed – this could be further expanded to reflect the key messages.

Priorities for collection development:

(genera, taxa, plant type, collecting zone, rare & threatened material etc.)

Addition of selected smaller species.
There is limited capacity to add tree material.

Brief history of collection:

Established after 2000, augmented by addition of new plants in ensuing years.

Horticultural management notes:

Fertilising/nutrition	Little needed.
Pest or disease issues & treatment	No major issues, unless infection from fungal pathogens (eg. Phytophthora cinnamomi - Cinnamon fungus, or Uredo rangelii – Myrtle Rust) becomes evident. Seek specific treatments advised for these or other pathogens.
Propagation	By seed or division as needed.
Cultivation	Little needed – mulching, using low P material.
Pruning	General ‘tidying up’ where necessary, and formative pruning to assist in achieving mature specimens of good form.

Reference material

(eg. literature, people, organisations, websites etc.)

Australian Plants Society (formerly SGAP) BGANZ (Botanic Gardens Australia & New Zealand) Dept. of Sustainability & Environment (DSE) (add)
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Collection Management Plan reviewed by:.....

Date of review: Next review recommended:.....

COLAC BOTANIC GARDENS - COLLECTION MANAGEMENT PLAN

Collection Name: Otway Ranges foothills - heathland

Location within site Fyans St Gate near Queen St

Collection category: (as per Living Plant Collections Policy and Plan)

Ecological, Research & Conservation

Objectives of collection:

1. Display a collection of characteristic species of the northern Otway Ranges foothills heathland vegetation.
2. Demonstrate plant associations commonly found in habitats of the foothills of the northern Otway Ranges
3. Display the range of Otway Ranges heathland species within selected genera.

Interpretation objectives:

(broad messages to be interpreted from collection)

1. The flora of the Otway Ranges foothills is rich and diverse.
2. The vegetation has developed over thousands of years, with fire as a major factor; most of the species are well-adapted to bushfires, and indeed rely on fire for regeneration.
3. The Victorian floral emblem (*Epacris impressa*) is a key species of the heathlands.
4. Knowing more about our local flora helps us to understand our environment.

Current status vs. objectives:

(assessment of gap)

Existing collection is housed in a bed area just inside the gate to Fyans Street, at the SE corner of the CBG. A good selection of species is currently growing, with scope to further enhance the collection with additional species and diversity.

Priorities for collection development:

(genera, taxa, plant type, collecting zone, rare & threatened material etc.)

Add rare & threatened species if available.

Brief history of collection:

Established after 2000, augmented by addition of new plants in ensuing years.

Horticultural management notes:

Fertilising/nutrition	Little needed.
Pest or disease issues & treatment	No major issues, unless infection from fungal pathogens (eg. <i>Phytophthora cinnamomi</i> - Cinnamon fungus, or <i>Uredo rangelii</i> – Myrtle Rust) becomes evident. Seek specific treatments advised for these or other pathogens.
Propagation	By seed or division as needed.
Cultivation	Little needed – mulching, using low P material.
Pruning	General ‘tidying up’ where necessary, and formative pruning to assist in achieving mature specimens of good form.

Reference material

(eg. literature, people, organisations, websites etc.)

Australian Plants Society (formerly SGAP)
BGANZ (Botanic Gardens Australia & New Zealand)
Dept. of Sustainability & Environment (DSE)
(add)

Collection Management Plan reviewed by:.....

Date of review: Next review recommended:.....

COLAC BOTANIC GARDENS - COLLECTION MANAGEMENT PLAN

Collection Name: Pittosporum

Location within site Scattered through various beds

Collection category: (as per Living Plant Collections Policy and Plan)

Cultural & Ornamental

Objectives of collection:

1. Display a collection of selected taxa from the genus *Pittosporum* that have been used in Victorian horticulture.
2. Display a range of cultivars from the genus *Pittosporum* selected or bred for ornamental value.
3. Display a range of *Pittosporum* that have historical connections with the CBG and gardens of the late nineteenth century in western Victoria.

Interpretation objectives:

(broad messages to be interpreted from collection)

1. *Pittosporum* is a diverse genus occurring in Australia and New Zealand, parts of Asia and Africa
2. While some native species can be weedy (eg. *Pittosporum undulatum*), there are many that are valuable garden plants with no weediness issues.
3. Many *Pittosporum* species and cultivars are very well-suited to growing in the local conditions.

Current list of plants:

The existing collection includes these taxa:

Pittosporum ?*buchananii*
P. ?*ralphii*
P. *crassifolium*
P. *eugenioides* 'Variegatum'
P. *eugenioides*
P. X 'Garnettii'
P. *tenuifolium* 'Eila Keightley'
P. *tenuifolium*
P. *tenuifolium* subsp. *colensoi*
P. *tobira*
P. *undulatum*

Priorities for collection development:

(genera, taxa, plant type, collecting zone, rare & threatened material etc.)

Further augment the collection with additional species and cultivars to show the range of useful garden plants within this genus, as the opportunity allows. For reasons of landscape amenity, distribute the collection within the site, rather than seeking to establish a bed of only *Pittosporum*.

Possible new accessions:

Pittosporum phillyrioides

P. resiniferum

P. bicolor

P. revolutum

P. obcordatum

P. lancifolium

P. argentifolium

P. angustifolium

P. ligustrifolium

Brief history of collection:

No documented record, but *Pittosporum* thought to have been included in site planting from 1800's, and certainly through 1900's.

Horticultural management notes:

Fertilising/nutrition	Most <i>Pittosporum</i> s are quite hardy, though application of a general organic fertilizer during spring and autumn will result in stronger, faster growth.
Pest or disease issues & treatment	Generally free from pests and diseases. Scale can occur on some larger-leafed species – treat with either winter oil or summer oil (depending on season).
Propagation	Seed or cutting.
Cultivation	Generally prefer uncompacted free-draining soils, apply mulch around young plants, avoid water-logging.

Pruning	General formative pruning when young; light canopy pruning (for shrubs) to encourage dense foliage growth.
Other	

Reference material

(eg. literature, people, organisations, websites etc.)

Heritage Victoria citation Patrick & Wallace report (1993) BGANZ Royal Botanic Gardens Melbourne (add)
--

Collection Management Plan reviewed by:.....

Date of review: Next review recommended:.....

COLAC BOTANIC GARDENS - COLLECTION MANAGEMENT PLAN

Collection Name: Palms (Arecaceae)

Location within site Scattered within site

Collection category: (as per Living Plant Collections Policy and Plan)

Cultural & Ornamental

Objectives of collection:

1. Display a collection of palms that are characteristic of the historic landscape style of CBG.
2. Display palm specimens for their individual amenity and visual interest.
3. Demonstrate a range of palms that suit the growing conditions of the local region.

Interpretation objectives:

(broad messages to be interpreted from collection)

1. Palms were widely planted as signature trees in nineteenth century landscapes in Victoria
2. The noted landscape designer William Guilfoyle often used palms (especially *Phoenix canariensis*) as feature specimens within his garden designs.
3. Palms add important texture and variety of form to garden landscapes, for strong visual effect.
4. *Phoenix canariensis* was commonly planted by 'Diggers' returning from the First World War, from seeds collected in foreign places. Many houses in the local area have palms from this period of planting.

Current plant list:

Butia capitata
Chamaerops humilis
Jubaea chilensis
Phoenix canariensis
P. roebelenii
Trachycarpus fortunei
Washingtonia filifera
W. robusta

Priorities for collection development:

(genera, taxa, plant type, collecting zone, rare & threatened material etc.)

Possibly add:
Phoenix sylvestris
P. dactylifera
Brahea armata

Brief history of collection:

Palms appear in early photographs of CBG – and are known to have been favoured by William Guilfoyle as featured elements in his garden designs. Most of the palms on site are 80-120 years old, approximately.

Horticultural management notes:

Fertilising/nutrition	Palms generally respond well to feeding with organic fertilizer, in the warmer months.
Pest or disease issues & treatment	Several species of Phoenix and Washingtonia are susceptible to Fusarium Wilt (<i>Fusarium oxysporum</i>), a fungal pathogen first recorded as the cause of the death of many palms in Centennial Park in Sydney in the early 1980's; has been recorded in inner Melbourne also. No currently effective treatment – infected palms will die, and must be removed hygienically and the material disposed of eg. in deep burial. Various other low-level pathogens infect palms, but usually not fatally.
Propagation	By seed.
Cultivation	Some palms (eg. Jubaea) take a long time to germinate – others are quicker. Feeding with high N will assist quicker growth when young. Plant out once the young palm is around 0.5m tall Transplant in warmer months – late spring to late summer.
Pruning	Occasional removal of old fronds (for aesthetic or safety reasons)
Other	

Reference material

(eg. literature, people, organisations, websites etc.)

Heritage Victoria citation
Patrick & Wallace report (1993)
BGANZ
Royal Botanic Gardens Melbourne
(add)

Collection Management Plan reviewed by:.....

Date of review: Next review recommended:.....

COLAC BOTANIC GARDENS - COLLECTION MANAGEMENT PLAN

Collection Name: Bush Tucker

Location within site

Collection category: (as per Living Plant Collections Policy and Plan)

Cultural & Ornamental

Objectives of collection:

1. Display a collection of selected plants that have been used as 'tucker' or food by indigenous Australians or other people.
2. Display a collection of edible plants with particular significance from the local region.
3. Display a collection of edible plants that also have value for their ornamental qualities.

Interpretation objectives:

(broad messages to be interpreted from collection)

1. Bush tucker plants often need to be prepared in certain ways or be eaten at particular times to avoid toxicity; Aboriginal people held valuable knowledge about edible local plants.
2. Some plants such as *Microseris lanceolata* were important food sources for local Aboriginal people.
3. Early European settlers used local species to make 'tea'.

Current list of plants:

Acacia pycnantha
Acacia retinodes
Acacia sophorae
Acacia verniciflua
Arthropodium milleflorum
Arthropodium strictum
Atriplex semibaccata
Bulbine bulbosa
Carpobrotus modestus
Carpobrotus rossii
Clematis microphylla
Coprosma quadrifida
Dianella revoluta
Kunzea pomifera
Leucopogon parvifolius
Lomandra longifolia
Mentha australis
Microseris lanceolata

Rubus parvifolius
Solanum laciniatum
Tetragonia implexicoma

Priorities for collection development:

(genera, taxa, plant type, collecting zone, rare & threatened material etc.)

Continue to source and try to establish extra plants. Suggested:

Exocarpus cupressiformis
Santalum acuminatum
Billardiera scandens
Sambucus gaudichaudiana
Enchylaena tomentosa
Burchardia umbellata
Pterostylis curta
Acacia ligulata
Acacia stenophylla
Acacia penninervis

Brief history of collection:

Developed by current horticulturist Laurence Towers with assistance of Bob Shoebridge in 2007.
--

Horticultural management notes:

Fertilising/nutrition	.Little required.
Pest or disease issues & treatment	.Browsing by possums can caused physical damage. Treatment difficult.
Propagation	By seed, cutting or division as needed to replenish stock.
Cultivation	Aim to keep plants growing quite close together to discourage foot traffic (kids), and to avoid soil compaction as a result.
Pruning	Keep path clear from foliage. Prune old or damaged stems as needed.
Other	

Reference material

(eg. literature, people, organisations, websites etc.)

Locally indigenous Aboriginal people. Australian Plants Society (formerly SGAP) BGANZ (Botanic Gardens Australia & New Zealand) Dept. of Sustainability & Environment (DSE)
--

(add)

Collection Management Plan reviewed by:.....

Date of review: Next review recommended:.....

APPENDIX B:

DEVELOPMENT and ENHANCEMENTS 1993 to 2011

The following table of prioritised items was included in the Colac Botanic Gardens Conservation Study (Patrick & Wallace 1993). The meaning of short-term, medium-term and long-term were defined thus:

Short-term: should be implemented within 5 years, dependent on budgets

Medium-term: should be completed within 10 years

Long-term: may not be undertaken for some time, as budgets become available

Cost estimates included in the original table are as listed in the 1993 report, but are unlikely to reflect current (2011) or future values.

Short-term priorities	Cost estimate	Current status
Curator's Residence redevelopment	\$40,000	Redevelopment completed, café operating successfully.
Removal of bollards	\$10,000	Completed
Establishment of climbers on Arbour		Completed
Treatment of Lily Pond	\$5,000	Lily Pond repaired, renovated and operational.
Painting of Angling Club rooms		Not completed
Painting and architectural treatment of toilet block	\$4,000	Completed
Removal of barbeque shelter	\$1,000	Not completed
Consultant study of playground	\$4,000	Completed, playground enhanced (2006).
Replacement of Rotary sign	\$250	Completed
Assessment and treatment of trees in playground	\$2,500	Continuing
Resurfacing of playground	\$4,000	Completed
Removal of bulldozer	\$250	Completed
Removal of fitness track	\$250	Completed
Planting in and around caravan park	\$3,000	Partially completed
Reconstruction of pedestrian paths		Paths reinstated as planned

Appointment and training of staff		Horticulturist appointed, professional development continuing; apprentice usually allocated to CBG
Extension of present irrigation system	\$25,000	In-ground (generally pop-up) system extended to most parts of gardens.
Promotion of Gardens	\$2,500	Limited promotion undertaken
Interpretation of Gardens	\$5,000	Several interpretive signs installed on site (eg. Otways flora, sensory garden, bush tucker)
Halting of vehicular access to the Gardens		Not attempted
Review of regulations for the Gardens and Public Reserve		Not Completed
Adoption of a policy of 'sustained amenity'		Continuing
Adoption of a low maintenance policy		Partially adopted (eg. lupins in Dahlia Bed)
Increase in plant diversity		Continuing
Implementation of a propagation program		Some propagation undertaken
Adoption of mulching as a standard practice		Generally adopted – could be increased
Establishment of indigenous planting	\$3,000	Indigenous collection developed at east end of Gardens; interpretation installed
Screen planting at the junction of Queen and Fyans Streets	\$2,500	Some planting implemented at entry zone.
Modification and screening of staff facility		Generally screened by plants.
Implementation of guidelines for Fyans Street	\$10,000	Platanus sp. not planted along CBG side of street; power lines still on south side of street.
Reinstatement of historic pathways	\$5,000	Pathways within Gardens reinstated
Construction of pedestrian/bike paths	\$6,000	Some paths constructed; foreshore linked by path to

		gardens 2012
Medium-term priorities	Cost estimate	Current status
Location of drinking fountain near playground	\$12,000	Completed near liberty swing
Removal of chain-link fence, replacement with picket fence	\$25,000	Chain-link replaced with metal fence
Construction of breakwater	\$8,000	Promontory constructed, installation of interpretive display
Renovation of Lake Colac Rowing Club	\$15,000	New roof installed, some screening planting
Removal of Post and Rail fence	\$1,000	Partially completed
Removal of Fire Brigade storage shed	\$2,500	Not completed - shed remains
Construction of single lane roadway	\$28,000	Not completed; path now along road
Installation of picnic and barbeque facilities	\$5,000	Picnic and barbeque facilities installed in foreshore 'common' zone
Establishment of additional indigenous foreshore planting	\$1,000	Continuing, completed in mosaic area and each side of path between rowing club and yacht club
Planting of shade trees around reserve carpark	\$2,500	Partially completed
Establishment of a plant index system	\$3,000	Completed, but further development of computerised plant census desirable
Planting of Otway flora in beds L & N		Otway flora established in beds to NE of depot
Reinforcement of planting on Gellibrand and Queen Streets	\$5,000	Partially completed

Long-term priorities	Cost estimates	Current status
Flagpole reconstruction	\$2,000	Not completed
Cannon restoration	\$12,000	Completed

Construction of rotunda/pavilion	\$40,000	Completed (foreshore) 1999
Reconstruction of terraces	\$6,000	Not undertaken
Removal of Angling Club rooms		Angling Club rooms remain
Provision of an education facility	\$3,000	Not undertaken (considered in this plan)
Development of Public Purposes Reserve	\$10,000	Area of site dedicated to public purposes (picnic ground etc.)
Reassessment of this report in light of changed conditions		Addressed in the current document

APPENDIX C:

LANDSCAPE DEVELOPMENT PRIORITIES

10 Year Outlook (2012-2022)

The table below contains a guide for year-by-year projects to be implemented within the Colac Botanic Gardens. These arise from review of the 1993 Conservation Study (Patrick & Wallace 1993), and review of existing living and built landscape opportunities and issues. The passage of time through the ten year period from 2012 will inevitably mean the the table will require some degree of adjustment, and should be used as a guide only. Unforeseen circumstances or opportunities may arise, meaning that priorities may change in order to achieve the best outcomes from these developments.

In the outer years of the 10 year outlook, the number of items is diminished, but these will no doubt be augmented by new priorities over that period. The report should be seen in that sense as a 'living document', which needs review and reprioritisation every few years to remain accurate and useful.

The table does not contain all recommendations of this report – some are qualitative or continuing processes, such as assessing the weed risk potential of new accessions, or timing of planting within seasons. See recommendations within the report for these items in their context.

The approximate cost is for general estimation purposes only, and will need to be reassessed and updated annually to keep step with future monetary value and changes in costs of materials and labour.

It is important to understand that the sum of each year of costed actions should not be seen as the total recommended operating budget for the CBG, as there are various general activities not included or not costed in this table.

Year	Item/Description	Approximate cost (2012 value)
1	Ensure that general and detailed information about CBG, its living collections and cultural importance is easily locatable and accessible on the Shire's website, or establish a linked site for CBG.	In-house (Shire); or \$2000 if external
	Carry out regular inspection of susceptible species of Myrtaceae for symptoms of Myrtle Rust; prepare Myrtle Rust action plan for contingency of detection on site	

	Establish site hygiene protocols for garden tools and equipment, and vehicles (including those of contractors)	In-house; \$1500 if external consultant advice required
	Initiate implementation of Living Collection Plan, focusing on accessing species consistent with Living Collection Management Plans	
	Carry out annual inspection of gravel paths; identify high priority areas for renovation or repair; as identified, resurface gravel paths on prioritized basis.	\$3000
	Relocate rubbish skip away from Café pedestrian entry area	
	Tree maintenance: survey condition of trees; carry out general remedial works	In-house? \$10,000 p.a. if external
	Implement annual mulching program for garden beds and under canopy of selected trees as needed.	\$2,000 p.a. if external mulch required
	Identify lawn areas for introduction of warm season grasses; commence staged implementation	\$1500
	Investigate options for soil moisture sensing	\$3,000
	Implement changes to traffic access and parking as recommended (subject to Council approval); monitor changes and public traffic behaviour	\$2,500
	Confirm option for construction of facility for housing Friends of CBG on site; initiate concept planning; initiate fundraising	\$35,000 (concept design)
	Examine options for relocation of fire training track tower to eastern end of track, out of main view from lookout.	\$1,500
	Establish plan and timeframes for removal and relocation of fire brigade training track to alternate site and post-removal improvement of site; establish plans for reinstatement of terraced seating area subsequently; investigate options for community use of area	\$5,000 planning & design costs

	for events and gatherings.	
	Develop plans and designs for improved visitor information signs regarding the CBG and its plant collections, for visitors entering the café zone; include brochures or other media for patrons of café.	\$3,000
	Establish plan for botanically interesting plant displays in café zone, appropriate for a botanic gardens setting; implement plans as appropriate	\$1,500
2	Prepare a detailed survey and site plan for CBG	In-house (Shire)
	Develop style guide for interpretive signs within CBG	\$2,500
	Review results of traffic changes; implement adjustments as needed and agreed.	\$3,000
	Renew/replace main entry information signs, including information about living plant collections on site	\$8,000
	Continue implementation of Living Collection Plan, focusing on accessing species consistent with Living Collection Management Plans	
	Implement soil moisture sensing option	\$20,000
	Tree maintenance: survey condition of trees; carry out general remedial works	In-house? \$10,000 p.a. if external
	Continue mulching program	\$2,000 p.a. if external mulch required
	Paint Colac Anglers' Club building in neutral tone to soften visual impact; plan and introduce screening planting.	\$10,000
	Carry out annual inspection of gravel paths; identify high priority areas for renovation or repair; as identified, resurface gravel paths on prioritized basis.	\$3,000

	Finalise concept plan for new Friends facility; undertake detailed design works; continue fundraising	\$15,000
	Plan and implement renovations of 1-3 beds within the CBG, as guided by priority list in this report	\$6,000
	Continue staged introduction of warm season grasses to lawn areas	\$1,500
	Carry out basic maintenance on old toilet block, including removal of graffiti; close access from northern entry; inspect and remove graffiti as needed.	\$5,000
3	Remove bed QQ; plan, design and reintroduce bed close to arbour (old bed RR); replace climbing roses on arbor as needed.	\$5,000
	Continue implementation of Living Collection Plan, focusing on accessing species consistent with Living Collection Management Plans	
	Develop plans for integration of Colac street trees and urban forest with CBG collections (including Barongarook Ck); develop interpretive themes and public information strategy	In-house
	Check surface of gravel walking paths – resurface as necessary	\$3,000
	Implement recommended solution to relocation of fire training track tower to eastern end of track, out of main view.	\$5,000
	If necessary funding achieved, initiate construction of new Friends facility	?\$350-400,000
	Develop modules and content for schools' education programs to be based at CBG	In-house, or \$7,500 if consultant
	Plan and implement renovations of 1-3 beds within the CBG, as guided by priority list in this report	\$6,000
	Carry out annual inspection of gravel paths; identify high priority areas for renovation or repair; as identified, resurface gravel paths on	\$3,000

	prioritized basis.	
	Tree maintenance: survey condition of trees; carry out general remedial works	In-house? \$10,000 p.a. if external
	Continue mulching program	\$2,000 p.a. if external mulch required
4	Plan and implement renovations of 1-3 beds within the CBG, as guided by priority list in this report	\$6,000
	Continue implementation of Living Collection Plan, focusing on accessing species consistent with Living Collection Management Plans	
	Tree maintenance: survey condition of trees; carry out general remedial works	In-house? \$10,000 p.a. if external
	Carry out annual inspection of gravel paths; identify high priority areas for renovation or repair; as identified, resurface gravel paths on prioritized basis.	\$3,000
	Finalise construction of new Friends' facility	TBC
	Implement pilot modules of schools' education programs	\$5,000
	Continue mulching program	\$2,000 p.a. if external mulch required
5	Fully implement schools education programs	Part-self-funding; \$7,000
	Continue implementation of Living Collection Plan, focusing on accessing species consistent with Living Collection Management Plans	
	Plan and implement renovations of 1-3 beds within the CBG, as guided by priority list in this	\$6,000

	report	
	Carry out annual inspection of gravel paths; identify high priority areas for renovation or repair; as identified, resurface gravel paths on prioritized basis.	\$3,000
	Tree maintenance: survey condition of trees; carry out general remedial works	In-house? \$10,000 p.a. if external
	Continue mulching program	\$2,000 p.a. if external mulch required
6	Plan and implement renovations of 1-3 beds within the CBG, as guided by priority list in this report	\$6,000
	Continue implementation of Living Collection Plan, focusing on accessing species consistent with Living Collection Management Plans	
	Carry out annual inspection of gravel paths; identify high priority areas for renovation or repair; as identified, resurface gravel paths on prioritized basis.	\$3,000
	Tree maintenance: survey condition of trees; carry out general remedial works	In-house? \$10,000 p.a. if external
	Continue mulching program	\$2,000 p.a. if external mulch required
7	Plan and implement renovations of 1-3 beds within the CBG, as guided by priority list in this report	\$6,000
	Continue implementation of Living Collection Plan, focusing on accessing species consistent with Living Collection Management Plans	
	Carry out annual inspection of gravel paths; identify high priority areas for renovation or repair; as identified, resurface gravel paths on	\$3,000

	prioritized basis.	
	Tree maintenance: survey condition of trees; carry out general remedial works	In-house? \$10,000 p.a. if external
	Continue mulching program	\$2,000 p.a. if external mulch required
8	Plan and implement renovations of 1-3 beds within the CBG, as guided by priority list in this report	\$6,000
	Continue implementation of Living Collection Plan, focusing on accessing species consistent with Living Collection Management Plans	
	Carry out annual inspection of gravel paths; identify high priority areas for renovation or repair; as identified, resurface gravel paths on prioritized basis.	\$3,000
	Tree maintenance: survey condition of trees; carry out general remedial works	In-house? \$10,000 p.a. if external
	Continue mulching program	\$2,000 p.a. if external mulch required
9	Plan and implement renovations of 1-3 beds within the CBG, as guided by priority list in this report	\$6,000
	Continue implementation of Living Collection Plan, focusing on accessing species consistent with Living Collection Management Plans	
	Carry out annual inspection of gravel paths; identify high priority areas for renovation or repair; as identified, resurface gravel paths on prioritized basis.	\$3,000
	Tree maintenance: survey condition of trees; carry out general remedial works	In-house? \$10,000 p.a. if

		external
	Continue mulching program	\$2,000 p.a. if external mulch required
10	Plan and implement renovations of 1-3 beds within the CBG, as guided by priority list in this report	\$6,000
	Continue implementation of Living Collection Plan, focusing on accessing species consistent with Living Collection Management Plans	
	Carry out annual inspection of gravel paths; identify high priority areas for renovation or repair; as identified, resurface gravel paths on prioritized basis.	\$3,000
	Tree maintenance: survey condition of trees; carry out general remedial works	In-house? \$10,000 p.a. if external
	Continue mulching program	\$2,000 p.a. if external mulch required

APPENDIX D:

CITATION ON VICTORIAN HERITAGE REGISTER

(listed December 2010)

Victorian Heritage Register (VHR) Number H2259

Level of Significance: Registered.

Location: 1-5 FYANS STREET COLAC, COLAC OTWAY SHIRE

Statement of Significance:

What is significant?

The Colac Botanic Gardens occupy an elevated site of approximately 16 hectares north-east of the town centre bounded by the southern shores of Lake Colac, Gellibrand Street, Fyans Street and Barongarook Creek.

The main entrance to the Colac Botanic Garden is through the south-west entrance Bilson gates (1962) on the corner of Fyans Street and Gellibrand Street where a carriage drive, lined with predominantly *Quercus robur* (English Oak) and few *Quercus cerris* (Turkey Oak), forms a row around the perimeter of the Gardens and is open to vehicle access. The area enclosed by the drive has a network of winding paths and is mainly open lawn with specimen trees, shrubberies, some bedding plants together with a palm bed, rose garden, rose arbour, pond and fountain, and cannon (acquired 1904) near the south eastern gate. The curator's cottage (c.1924, now a café) is located at the western end of the gardens with playground equipment, picnic facilities and car parking at the eastern end. A caravan park occupies the north-east corner along Barongarook Creek adjacent to the lake shore.

A steep escarpment planted with *Pinus radiata* (Monterey Pines) and specimen trees runs between the botanic gardens and the flat area around the shore of Lake Colac which contains remnant terracing, an old brick toilet block with castellated roof (c1930s), a walking track, a fire brigade asphalt training track and shed, rotunda (1999), car parks, a rowing club, angling club, public toilets, boat ramp (1968) and jetty (1971). The escarpment provides separation between the two areas and provides extensive views from the Botanic Gardens over Lake Colac.

The site was temporarily reserved in 1865 for botanical and recreational purposes after a request from local residents. Little progress was made until 1868 when Daniel Bunce, Director of the Geelong Botanic Gardens, was approached to lay out a plan for the garden. Implementation of the plan was slow with the construction of a carriageway and planting of trees the only known details.

Between c1875 -80, curators Reeves and McDonald made changes to the carriageway and introduced garden beds, curved paths, lawns and shady arbours. In the 1890s structures added to the gardens included a pavilion overlooking the lake a conservatory in the south-eastern corner and a permanent rowing clubhouse on the edge of the lake joining the existing structures of piers, baths and a boat shed. Most of these structures have been removed.

In 1910 William Guilfoyle, Director of the Melbourne Botanic Gardens, prepared a

plan and a 'Report on the remodelling and development of the Colac Botanic Gardens', which are extant, suggesting some improvements and remodelling to take advantage of the slope and vistas across over the lake which he considered had been ignored. This included simplifying the existing path system within the circular drive, and removal of borders and crowded areas in favour of larger trees and clumps of shrubs and a palm and cordyline bed all of which were implemented. Curators Archibald Campbell (1911-40) and Dugald Leitch (1940-55) were responsible for implementation of part of the Guilfoyle plan and maintaining the maturing Gardens but, with Guilfoyle's death in 1912, any further influence ended. The last resident curator Donald Greenwood (1955-65) was responsible for the addition of many native plants and in more recent times the gardens have more simplified planting and a park-like character.

The Colac Botanic Gardens contains many rare plant species only found in historic gardens and several significant and uncommon trees including four *Cupressus forbesii* (Tecate Cypress), a very large *Sophora japonica* (Pagoda Tree), a *Pittosporum tenuifolium* 'Eila Keightley' (Kohuhu), a large *Araucaria bidwillii* (Bunya Bunya Pine) and an outstanding *Ulmus x hollandica* 'Vegeta' (Huntington Elm). In March 1996, James Guilfoyle, grandson of William Guilfoyle, planted an *Arbutus canariensis* (Canary Island Strawberry Tree). In 2004 the Australian Plant Society planted an Otway Flora Bed on the eastern side of the Gardens.

This site is on the land of the traditional owners.

How is it significant?

Colac Botanic Gardens are of historical, aesthetic, and scientific (botanical) significance to the State of Victoria.

Why is it significant?

Colac Botanic Gardens are of historical significance as an important example of a regional botanical garden, established in the nineteenth century in response to the increased wealth of Victoria with the discovery of gold and the desire to provide a place for recreation and education in keeping with European trends.

The Colac Botanic Gardens are of historical importance through the association with Daniel Bunce and William Guilfoyle, two pioneers of botanic gardens and garden design in Victoria.

The Colac Botanic Gardens are of aesthetic significance due to their park - like character and elevated location immediately above the southern shore of Lake Colac, providing vistas across the lake. The gardens are of aesthetic significance for the sub-tropical plant groups supported by Guilfoyle together with his gardenesque style. They are of aesthetic significance for the contrasting form and variety of trees and plants which includes conifers, evergreen and deciduous plantings, together with the leaf shapes, colours and flowers, also contribute to the Garden's aesthetic quality and appeal.

The Colac Botanic Gardens are of scientific (botanical) significance for a number of rare plants and trees including four *Cupressus forbesii* (Tecate Cypress), the only known examples in Victoria, a large *Sophora japonica* (Pagoda Tree), *Pittosporum tenuifolium* 'Eila Keightley' (Kohuhu), and large *Araucaria bidwillii* (Bunya Bunya Pine) and an outstanding *Ulmus x hollandica* 'Vegeta' (Huntington Elm).

APPENDIX E:

CONSERVATION POLICY

(reproduced from Patrick & Wallace 1993. 'Colac Botanic Gardens. A conservation study' p49-50)

The existing form and layout of the Colac Botanic Garden and Recreation Reserve is sympathetic to their original form. Policies developed for the Gardens should retain and, as far as possible, conserve and reconstruct, nineteenth century character. At the same time management policies should recognise the need for the gardens to meet modern demands and accommodate various recreational activities.

Policy Statements

1. The Colac Botanic Gardens should be managed as a botanic garden while accommodating the original recreational intent of the site. Designs by Daniel Bunce appear to have been modified by succeeding Directors of the gardens, and though William Guilfoyle prepared a report and plan, much of this was not implemented. It should be policy to retain the gardens original form where possible and not to specifically implement William Guilfoyle's work.
 2. To extend the late nineteenth century quality of the Gardens, it should be policy to reconstruct lost garden structures, including surrounding fences, glasshouse and pavilion where significant evidence exists. Paths should be re-aligned to late nineteenth century alignments.
 3. The role of the reserve as a Botanic Garden and Recreation Reserve should be respected. Critical to this is a recognition of the vital role the Colac Gardens have played in the community of Colac. This role should be dynamic and on-going and the presence of a children's playground, caravan park, angling club etc. on the site should be maintained though the presence of the fire track is a major intrusion into the site and should be relocated at the earliest opportunity. Future development should respect the sensitive nature of the site and should be carefully assessed in terms of visual intrusion.
- In general it is recommended that no further recreational facilities other than those for which an historic precedent exists should be situated on the upper plateau area of the Gardens.
4. Vehicular access to the main site of the Botanic Gardens should be restricted. Access to the Recreation Reserve should be improved with provision of suitable parking facilities.
 5. Landscaping should be implemented to integrate the Colac Botanic Garden into the City of Colac, and protect their urban setting by suitable planning protection to adjacent buildings in Fyans Street. Suitable tree planting programmes should be implemented in Fyans, Queen and Gellibrand Streets.
 6. The diversity of plants currently contained in the Colac Botanic Gardens should not be reduced and increased diversity should be sought.

7. The use of indigenous vegetation along Lake Colac and Barongarook Creek should be encouraged.
8. Attention should be given to marketing, promoting and interpretation of the Colac Botanic Gardens to attract greater visitor numbers. This should be augmented by the provision of an interpretation centre and restaurant.
9. Horticultural Management strategies established in the Gardens should be dynamic and should be designed to extend the qualities currently present in the Gardens to the middle of the next century.

APPENDIX F:

Table of acceptable water quality parameters for irrigation
(reproduced with permission of RBG Melbourne)

RBG Melbourne Water Quality Parameters (For Irrigation Application)				
Parameter	Unit	Target Range	Phytotoxic Levels	Comments
Biological				
E.coli	orgs/100ml	<10		
Heminth	orgs/1L	<1		
Protozoa	orgs/50L	<1		
Viruses	orgs/50L	<1		
Blue-green algae	Cells/ml	<15,000		
Significant plant pathogen content		None		
Physico-chemical				
Alkalinity	mg/L	<100	40-500	
Alumnium	mg/L	<5	>5	
Arsenic	mg/L	<0.1		
Beryllium	mg/L	<0.1		
Bicarbonate (HCO ₃)	mg/L	<90		High levels impact uptake of iron
Biological Oxygen Demand (BOD)	mg/L	< 1		Class A = <10
Boron	mg/L	<0.3	>0.3-0.5	
CaCO ₃	mg/L	<130		
Cadmium	mg/L	<0.01		
Calcium	mg/L	<120		
Chlorine Cl ² (total)	mg/l	<0.1		
Chlorine Cl ² (free)	mg/l		4	
Chloride (CL ⁻) (overhead sprinklers)	mg/l	<40 - 100	>100	
Chloride (CL ⁻)	mg/l	<100-140	>100	
Chloride (CL ⁻)	me/L	<3.0	>3.0	
Chromium	mg/l	0.1		
Copper	mg/L	0.001	>0.2	
Fluoride	mg/L	<1.0		
Iron (soluble)	mg/L	<5		
Lead	mg/L	<5.0		
Lithium	mg/L	<2.5		
Manganese	mg/L	<0.2		
Magnesium	mg/L	<50		
Molybdenum	mg/L	<0.01		
Nickel	mg/L	<0.2		
Nitrogen (Total)	mg/L	< 5		
Nitrogen (Ammonia) NH ₄ -N	mg/L	< 5		
Nitrogen (Nitrate) NO ₃ -N	mg/L	< 5	>5-30	Class A = 5
pH	Units	6-7.5		

Phosphorous (Total)	mg/L	<0.05- 5	>15	Class A = 0.5
Salinity (EC)	dS/cm	<0.28-0.75	>1.2-3.0	
Salinity (TDS)	ppm	<180-480	>480-2000	
Selenium	mg/L	<0.02		
Sodium	mg/L	<50-100	>100-115	
(Sodium Absorption Ratio)	SAR	<3	>3-9	
Sulfate (SO ₄ ⁻²)	mg/L	<240		
Sulfur (S)	mg/L	<100		
Suspended Solids (TSS)	mg/L	<50		Class A = <5
Vanadium	mg/L	<0.1		
Zinc	mg/L	<2	>2	
Turbidity	NTU	<2		For effective disinfection

References

Irrigation Water Quality (1998), Vomocil JA and Hart J, Oregon State University Extension Service 1998
<http://extension.oregonstate.edu/catalog/pdf/fq/fq76-e.pdf>

Ayers, RS and Wescott, DW. (1994). Water quality for agriculture, FAO Irrigation and Drainage Paper 29 Rev. 1, Reprinted 1989, 1994
<http://www.fao.org/docrep/003/T0234E/T0234E00.HTM>

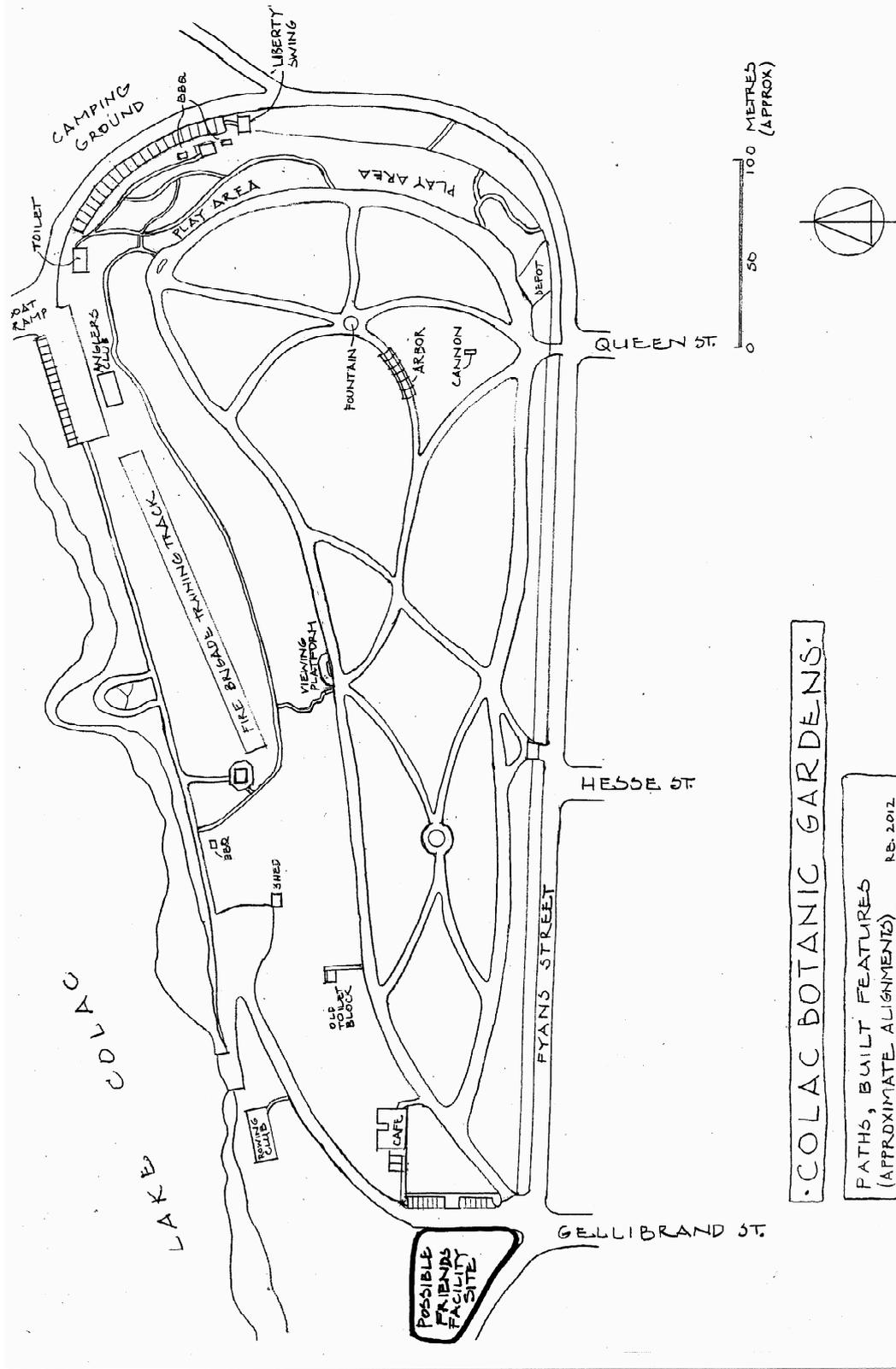
Handreck, KA and Black, ND. (2002). *Growing Media for Ornamental Plants and Turf*. (New South Wales University Press, Randwick, NSW).

Iowa State University Horticulture Guide (Website) *Irrigation Water Quality for Container-grown Plants*
<http://www.extension.iastate.edu/Publications/PM1699.pdf>

Nursery Industry Water Management Best Practice Guidelines
http://www.ngia.com.au/docs/Water_Manage_BMPG.pdf

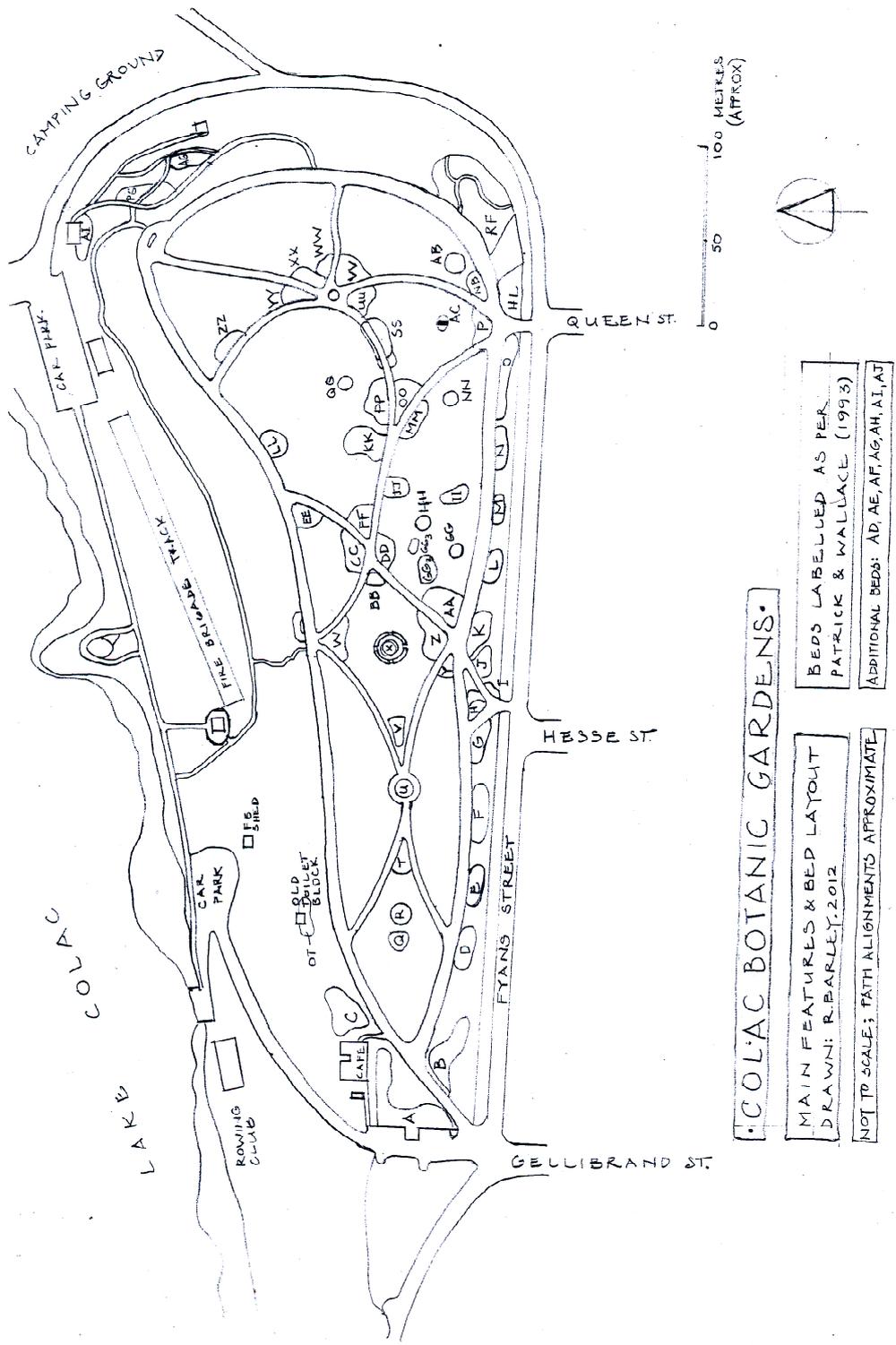
Australian and New Zealand Environment and Conservation Council and Agriculture and Resources Management Council of Australia and New Zealand (2000) Australian and New Zealand guidelines for fresh and marine water quality, Volume 1, The Guidelines (Australian and New Zealand Environment and Conservation Council: Canberra)

Rolfe C, Yiasoumi W, Keskula E. (2000). *Managing Water in Plant Nurseries, 2nd edition*, (NSW Agriculture, Orange, NSW)



COLAC BOTANIC GARDENS

PATHS, BUILT FEATURES
(APPROXIMATE ALIGNMENTS) AS 2012



COLAC BOTANIC GARDENS

MAIN FEATURES & BED LAYOUT
 DRAWN: R. BARLEY, 2012

BEDS LABELLED AS PER
 PATRICK & WALLACE (1993)

ADDITIONAL BEDS: AD, AE, AF, AG, AH, AI, AJ

NOT TO SCALE; PATH ALIGNMENTS APPROXIMATE

REFERENCES

Patrick, J & Wallace, K (1993). *Colac Botanic Gardens – A Conservation Study*, prepared for the then Shire of Colac by Patrick & Wallace Pty Ltd in 1993

Botanic Gardens Australia & New Zealand: www.bganz.org.au

Victorian Department of Primary Industries (Myrtle Rust & other diseases):

<http://www.dpi.vic.gov.au/forestry/pests-diseases-weeds/diseases/myrtlerust>

Royal Botanic Gardens Melbourne, Living Collections Plan (in RBGM Masterplan – 10 year Review 2009).

Victorian Heritage Register:

<http://www.dpcd.vic.gov.au/heritage/victorian-heritage-register>