WOODLAND FLORA RECOVERY ACTION PLAN

Phillip Island NATURE PARKS

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Contents

1.0 Introduction

This Recovery Action Plan (RAP) focuses on three rare woodland flora species with overlapping distribution and similar habitat characteristics. Slender pink fingers *Caladenia vulgaris* D.L.Jones (hereafter referred to as *Caladenia vulgaris*), Currant wood *Monotoca glauca* (Labill.) Druce (hereafter referred to as *Monotoca glauca*) and One-flower early Nancy *Wurmbea uniflora* (R.Br.) T.D.Macfarl. (hereafter referred to as *Wurmbea uniflora*) all coincide in an area of woodland on the northern and north-western fringe of Rhyll Wetland. This woodland is one of the most floristically diverse areas of Phillip Island (*Millowl*) and any management actions undertaken for the benefit of one species will have an impact on other species in the community. It is vital that the overall health of the ecosystem is taken into account and that all management actions proposed in this RAP contribute to an improvement in ecosystem health as well as benefitting the individual key species. All three woodland species are listed as 'rare' in Victoria under the Advisory list of rare or threatened plants in Victoria, meaning that they are "not considered otherwise threatened - there are relatively few known populations or the taxon is restricted to a relatively small area" (DEPI 2014).

1.1 Description

1.1.1 Caladenia vulgaris

Caladenia vulgaris is a terrestrial orchid (Orchidaceae) that grows to 35cm tall, with 1 or 2 small, dull pink flowers; labellum with a strap-like mid-lobe; tepals to 18mm long (Backhouse & Jeanes 2006). It flowers from October to December and is most easily identified by its tall slender flowering stem, a long leaf that almost reaches the flowers, and relatively small (to c. 12 mm across) dull pink, partially opening flowers (Vicflora 2020).

1.1.2 Monotoca glauca

Monotoca glauca is an Australian heath (Ericaceae) (Australian Native Plants Society, date?) with a dense, non-lignotuberous shrub or small tree to c.7 m high habit; branchlets puberulous. Leaves elliptic to oblanceolate, c. 8–26(–32) mm long, 2.1–6.5 mm wide, mucronate, flat to convex, glabrous, lower surface usually distinctly whitish; margins smooth, plane to recurved; petioles puberulous abaxially when young. Flowers 2–13, in axillary spikes or the lowermost solitary and pedunculate; lowermost spikes with peduncle (0.4-)0.8–3(-4) mm long, sterile bracts very rarely present; bracts, bracteoles and sepals obtuse; bracts persistent, 0.3–1.2 mm long; bracteoles 0.4–1.1 mm long; sepals 0.6–1.3 mm long; corolla rotate-campanulate, 1.1–1.8 mm long in female flowers; 1.4–2.3 mm long in males; lobes glabrous to papillose, slightly to c. twice as long as tube; anthers 0.6–1.1 mm long, exerted from corolla tube; ovary plus style 0.8–1.2 mm long. Fruit ovoid, ellipsoid or spherical, 1.8–2.4 mm long, and greyish-purple at maturity; Flowers September through to April (Vicflora 2020).

1.1.3 Wurmbea uniflora

Wurmbea uniflora is a herbaceous member of the Colchicaceae family, 4–17cm high, monoecious. Leaves 3, linear, the lowermost without expanded sheathing base, 3–8 cm long, 1.5–2 mm wide. Flower solitary (rarely twinned); tepals narrowly ovate, 5–7 mm long, very shortly fused basally, spreading, white; nectaries 2 per tepal situated about one-third from base, narrow, marginal, prominently thickened, white; stamens from two-thirds to three-quarters as long as tepals, anthers yellow; ovary 2–3 mm long. Flowers September through to January (Vicflora 2020).

A)

B)

C)

Figure 1: A) *Caladenia vulgaris*, B) *Monotoca glauca*, C) *Wurmbea uniflora*.

1.2 Distribution

1.2.1 Caladenia vulgaris

Caladenia vulgaris is found in scattered populations across South Australia, Victoria and Tasmania growing in heathland and coastal scrub on moisture-retentive sandy soils (Vicflora 2020). They have been found on Phillip Island within Herb-rich Foothill Forest/Grassy Woodland Complex (EVCs 23/175) and Damp Sands Herb-rich Woodland (EVC 3). On Phillip Island, Frood (2008) located several small populations in Oswin Roberts Reserve and in the north-eastern corner of Rhyll Swamp during the orchid survey of 2007-2008. He observed a total of at least 30 plants but notes that they can be easily overlooked when not flowering so the population may be higher. Targeted searches in 2018 and 2019 have identified the continued presence of the populations found in 2007-2008 as well as several other populations in Oswin Roberts, the Koala Conservation Reserve and Ventnor Koala Reserve (see Fig. 2). The largest population was recorded at Ventnor Koala Reserve and estimated at 100-200 within approximately 0.1 ha.

1.2.2 Monotoca glauca

Monotoca glauca occurs on infertile sandy soils at sea-level or on near-coastal high-rainfall ranges, in open-forest, heathy woodland, wet closed scrub and margins of cool-temperate rainforest (Vicflora 2020).

The main population of *M. glauca* on Phillip Island is found within Herb-rich Foothill Forest/Grassy Woodland Complex (EVCs 23/175) and Damp Sands Herb-rich Woodland (EVC 3). Crowfoot et al. (2006) estimated the population to be approximately 200 with all plants recorded as being mature and many senescent. Subsequent observations have shown that there has been a continuation of mature plants senescing, however remaining mature plants are continuing to develop new foliage, flower, fruit and set seed. A site visit in August 2019 showed some positive signs of natural recruitment occurring with several seedlings detected nestled within the dead brush of some senescent plants. A small population of 5 plants and 3 outlying plants are within the Herb-rich Foothill Forest/Grassy Woodland Complex EVC in Oswin Roberts Reserve (see Fig. 2). In 2008 this population was recorded as having 11 mature plants and 6-10 senescent plants so there has been a steep decline in the last 10 years. For this species to be present in this site is unusual given that the soil type is Merricks clay and not siliceous sands.

1.2.3 Wurmbea uniflora

Wurmbea uniflora is mostly found in moist, heathy lowland sites. They have been found on Phillip Island within Herb-rich Foothill Forest/Grassy Woodland Complex (EVCs 23/175). Frood (2008) located populations of *W. uniflora* in the north-eastern corner of Rhyll Wetland and they continue to persist in this vicinity (see Fig. 2). Presently there is a large patch of several hundred scattered across an area of about 10sqm and a few patches on the fire track. There is some concern that the earlier timing of slashing the track in recent years has affected these population sizes. *Wurmbea uniflora* was also recorded at the Rhyll Cricket Ground in 2018 with approximately 100 plants occupying an area of about 5 sq m.

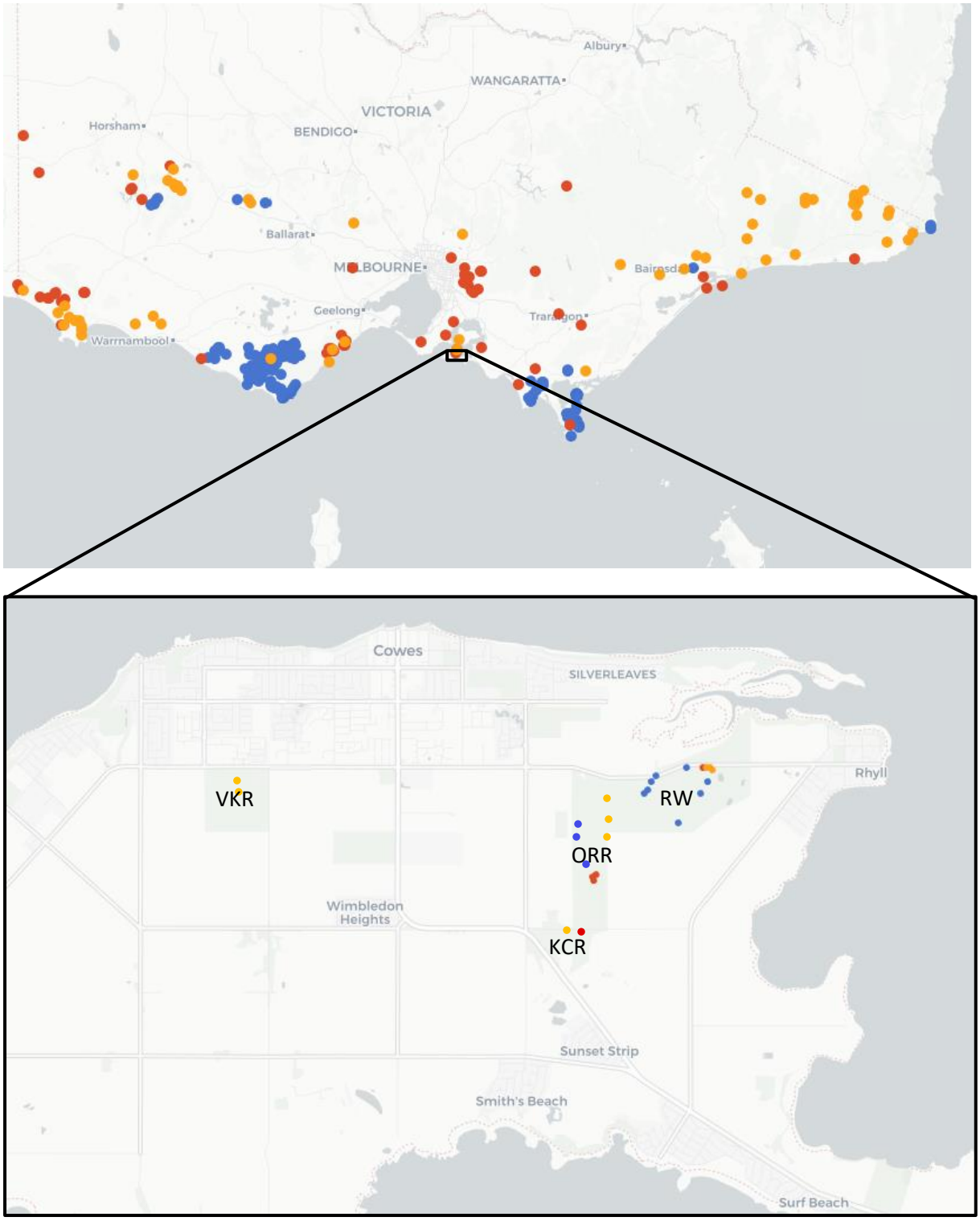

Figure 2: Victorian and Phillip Island (insert) distribution of: *Caladenia vulgaris* (yellow), *Monotoca glauca* (blue), and *Wurmbea uniflora* (red). VKR: Ventnor Koala Reserve; KCR: Koala Conservation Reserve; ORR: Oswin Roberts Reserve; RW: Rhyll Wetland. Output by Atlas of Living Australia (2020).

2.0 Population Threats

A summary of the threats and which species they affect is summarised in Table 1. Below are more in-depth descriptions of each threat and how they affect each of the woodland species.

Table 1: Summary table of threats affecting each of the woodland species (green = affected).

Threat	*C. vulgaris*	*M. glauca*	*W. uniflora*
Herbivory			
Weed invasion			
Competition			
Smothering			
Reduced canopy density			
Inappropriate biomass management			
Poor recruitment			
Pathogens			

2.1 Herbivory

For each of the woodland species, browsing by swamp wallabies, brush tailed possums, ring tailed possums and rabbits is a notable and concerning pressure on the populations persisting on Phillip Island. Specifically regarding *Monotoca glauca*, Crowfoot (2006) considered it to be unknown whether browsing by Swamp wallabies (*Wallabia bicolor*) and rabbits were threatening. However, observations by Nature Park staff in recent times show there is a distinct browse line evident on the mature trees. Wildlife surveillance cameras have shown that wallabies reach up as far as they can to graze, which coincides with the lower canopy line that is now evident (Fig. 3). There is also evidence of gnawing on the bark of some mature plants. Given that we have now discovered some natural recruitment occurring, these seedlings appear to be under great threat of grazing by herbivores. They have managed to germinate in the protection of dead brush from collapsed senescent plants but there is evidence that once the plants are emerging above the brush they risk being grazed by both native and pest animals.

Figure 3: A) Swamp wallaby stretching up to browse on *M. glauca*; B) Bark stripping of *M. glauca* branch from a Swamp wallaby (image: Phillip Island Nature Parks).

2.2 Weed invasion

Sweet vernal grass (*Anthoxanthum odoratum*) poses existential threats to all three of the woodland species; it is a perennial grass that colonises readily, tolerates saline soils, and is able to compete vigorously with native herbs and grasses for resources.

Specific for *Monotoca glauca*, the following introduced plants are also causes of concern: Bridal creeper (*Asparagus asparagoides*), Sweet pittosporum (*Pittosporum undulatum)*, Mirror bush (*Coprosma repens),* Panic veldt Grass (*Ehrhata erecta)*, African daisy (*Senecio pterophorus*), Large quaking grass (*Briza maxima*), Mouse-eared chickweed (*Cerastium glomeratum)*, Squirrel tail fescue *(Vulpia bromoides*), and Cleavers (*Galium aparine*), as well as potentially Dolichos (*Dipogon lignosus)* and Gorse (*Ulex europaeus*) (Crowfoot et.al 2006). The vegetation alongside the Cowes-Rhyll Rd and the adjacent walking track – a stronghold for *M. glauca* – is particularly degraded, being impacted by weed species such as Angled onion (*Allium triquetrum*), Panic veldt grass and Cleavers.

2.3 Competition

For *Caladenia vulgaris* and *Wurmbea uniflora*, the closure of groundcover vegetation and competition with native grasses and other scrub species, such as Weeping grass (*Microlaena stipoides*), Austral bracken (*Pteridium esculentum*) and Hop goodenia (*Goodenia ovata*) is putting additional pressures on the Island's populations.

Monotoca glauca and many of the other woodland species such as Sweet bursaria (*Bursaria spinosa* subsp*. spinosa*) and Scented paperbark (*Melaleuca squarrosa*) are facing similar grazing pressures and are not developing new plants to maturity. These species would also benefit from protection, however Stinkwood (*Zieria arborescens*) appears to be thriving. Crowfoot (2006) considered the massive recruitment of Stinkwood to be a potential competitive threat to the Island's *M. glauca* populations**.**

2.4 Smothering

The on ground build-up of leaf litter and other organic material may inhibit seed germination for *Caladenia vulgaris* (Frood 2019).

2.5 Reduced canopy density

The dieback of trees observed in some areas of Oswin Roberts Reserve and Rhyll Wetland has severely reduced the density of the woodland canopy. This in turn increases the light and heat penetration to the ground level and can favour other species in competition with *Caladenia vulgaris* and *Wurmbea uniflora*.

2.6 Inappropriate biomass management

Historical management practices may be inappropriate regarding the habits of *Caladenia vulgaris* and *Wurmbea uniflora.* The timing of slashing fire access tracks or fuel reduction burning must avoid the flowering period for *C. vulgaris* (October – December) and *W. uniflora* (September – January) (see Appendix 1).

2.7 Poor recruitment

Specific to *Monotoca glauca*, Crowfoot (2006) noted that exotic grasses such as Panic veldt -grass is likely to be impeding recruitment. This was, however, considered to be difficult to manage so it was suggested that the best solution would be propagating seedlings and planting back into the heathy

woodland. Since Crowfoot conducted the survey in 2006 some natural recruitment has been observed so efforts must be made to nurture and protect these plants to ensure they can reach maturity.

2.8 Pathogens

Monotoca glauca is susceptible to, and thought to be affected by, the water mould *Phytophthora cinnamomi*, but the degree of susceptibility has not been documented (DAWE 2006). Soil testing in 2019 has not detected any presence of the fungus on Phillip Island. However, it is an easily spread disease so a potential threat remains. A walking/cycling track along the northern edge of the Rhyll population is an avenue for potential infection as it can easily be transmitted from infected soil attached to shoes and bike tyres. Gravel introduced for track surfacing and machinery used for management practices can also introduce the pathogen (DoE 2014).

3.0 Existing Conservation Measures

Currently there are no conservation measures in place for both *Caladenia vulgaris* and *Wurmbea uniflora*, and as a result are currently suffering unintended consequences from the inappropriate biomass management practices listed above. The Island's population of *Monotoca glauca* is the only woodland species currently being actively managed for conservation. Below are descriptions of those current conservation measures in place for *M. glauca*.

3.1 Weed removal

Sweet pittosporum growing within the *Monotoca glauca* populations have been targeted for removal since 2007. Annual follow up work treating regrowth of stumps and removing emergent seedlings has also occurred. Other weeds targeted through the Nature Parks weed control program within this vicinity include Bridal creeper, Gorse, Watsonia (*Watsonia meriana var. bulbilifera),* Dolichos, Spear thistle (*Cirsium vulgare*), Blue periwinkle (*Vinca major*), Inkweed (*Phytolacca octandra)*, Yorkshire fog *(Holcus lanatus)*, Angled onion and a number of unspecified introduced grasses.

3.2 Cultivation and replanting

The propagation of 60 new seedlings and planting back into the Rhyll and Oswin Roberts populations occurred in 2009. These were protected with tree guards to protect against herbivores but unfortunately there have been no survivors. *Monotoca glauca* is known to have fine roots, does not like disturbance and does not transplant well so many plants failed within the first year and those that initially thrived gradually followed suit. They were not watered during the dry summer or until establishment which most likely also contributed to their demise.

Figure 4: Cultivated *M. glauca* showing new spring growth 3 months after planting, Oswin Roberts Reserve (image: Susan Spicer).

3.3 Protection against grazing animals

Naturally recruited seedlings are being protected against grazing by applying tree guards, marking their locations on 'Collector for ArcGIS' mapping system and ongoing monitoring.

4.0 Recovery Objectives and Actions

The overall objective of recovery is to minimise the probability of extinction for each of the three threatened plant species in the Nature Park woodlands and to increase the probability of those populations becoming self-sustaining in the long term.

This RAP guides recovery actions for the three threatened woodland species and will be implemented and managed by Phillip Island Nature Parks' staff, volunteers and community groups as appropriate. Technical, scientific, habitat management or education components of the RAP will be referred to specialist groups on research, *in situ* management, community education and cultivation as required. The RAP will run for a maximum of five years from the date of its adoption and will be reviewed and revised within five years of the date of its adoption.

All three species exist within similar habitat and are subject to similar threats so a holistic approach will be taken in setting many of the recovery actions. There are also many other locally significant species that will benefit from the actions and as such there will be a flow on effect.

Table 2: Summary table of the recovery objectives and the applicable actions, species, and their indicators of success.

Objective **(Action)**	Description	Species Targeted			Indicators of Success
		C. vulgaris	*M. glauca*	*W. uniflora*	
Objective 1 **(1)**	**Determine distribution, abundance and population structure**				
1.1	Undertake surveys to determine the area and extent of populations, the number, size and structure of populations and inference or estimation of population change				All known sites are mapped for population size, condition and habitat
1.2	Contribute to the Victorian Biodiversity Atlas by lodging records with VBA				Records lodged with VBA
Objective 2 **(1, 4)**	**Determine habitat requirements**				
2.1	Survey known habitat and collect floristic and environmental information relevant to community ecology and condition				Species/habitat specific survey design prepared and implemented
2.2	Establish trial plots experimenting with slashing and burning to identify optimal habitat requirements				Recruitment rates across different treatments are accurately recorded
Objective 3 **(4)**	**Ensure that all populations and their habitats are protected and managed appropriately**				
3.1	Adjust the timing of slashing firebreaks at Rhyll wetland and Koala Reserve to the dormancy period in the plants life cycles and incorporate this into the Nature Parks Fire Plan				Management activities have no negative impact on populations
3.2	Ensure staff and contractors are aware of the locations of the populations and protect against off-target herbicide impacts, trampling or disturbance				Management activities have no negative impact on populations
Objective 4 **(2, 3, 4)**	**Manage threats to populations**				

4.1	**Control threat from native herbivores and pest animals**				
4.1.1	Search for and guard germinants				Guard at least 50% of known germinants annually and record over 50% survival
4.1.2	Trial wallaby and rabbit exclusion fencing around some mature plants				Natural recruitment is observed
4.1.3	Monitor for breaches in wallaby and rabbit exclusion fencing around the Koala Reserve South plantation				No plants are lost to herbivory
4.1.4	Trial protection with wire cages to determine the impact of herbivores				Herbivores are successfully excluded from individual plants
4.2	**Control threat from pest plants**				
4.2.1	Weed control should be carried out in accordance with the Nature Parks Weed strategy				Reduction of H priority weeds by 80%; Reduction in M priority weeds by 50%
4.2.2	Monitor for new and emerging weeds				New weed threats are identified if they occur
4.3	**Manage microhabitat**				
4.3.1	Rake and remove leaf litter build up VKR and South plantation				Increase in population size by 20%
4.3.2	Reduce competition with groundcover vegetation by slashing				Increase in population size by 20%
4.3.3	Protect naturally recruiting over-story plants from herbivores to maintain the woodland canopy				Guard at least 50% of known germinants annually and record over 50% survival
4.4	**Manage threat from pathogens**				
4.4.1	Monitor for signs of infection by *Phytophthora spp.*				Any signs of infection are detected early
4.4.2	A high standard of soil hygiene of footwear, tools and machinery is maintained by Nature Parks staff and contractors				No infections are introduced by staff or contractors

4.4.3	Ensure track toppings introduced into the Nature Parks are Phytophthora free				Introduced toppings do not introduce pathogens
Objective 5 **(1)**	**Identify key biological functions**				
5.1	Evaluate current reproductive status, longevity, fecundity and recruitment levels				Reproductive status, longevity, fecundity and recruitment levels are determined
5.2	Identify key stimuli for seed germination requirements				stimuli for recruitment identified
Objective 6 **(1, 4)**	**Determine the growth rates and viability of populations**				
6.1	Measure population trends and responses against recovery actions by collecting demographic information including recruitment and mortality, timing of life history stages and morphological data.				Techniques for monitoring developed and implemented. Population growth rates determined
Objective 7 **(5)**	**Establish a population in cultivation**				
7.1	Establish a seed bank and determine seed viability.				Viable seeds for all three species are in storage at Barb Martin Bushbank
7.2	Establish plants in cultivation to safeguard against destruction of wild populations, provide a research population and potentially for reintroductions				Development of effective propagation and cultivation techniques. At least 50 healthy, genetically diverse, mature plants in cultivation
Objective 8 **(5)**	**Establish new populations in the wild**				
8.1	Select and evaluate a potential reintroduction site that is ecologically suitable				Criteria for site suitability identified and site selected
8.2	Prepare site to achieve maximum survival of plants				Selected site prepared and potential threats addressed
8.3	Introduce plants from cultivation				At least 50 cultivated plants introduced into the reintroduction site
8.4	Nurture and maintain protection of young plants to maturity				50% survival of plants
Objective 9 **(5)**	**Build community support for conservation**				

9.1	Raise awareness of rare plants within the community through the Nature Parks Threatened Species Communication Plan and Educational and Interpretaion programs				Threatened Flora have been incorporated into two Education Department talks, community engagement activities are initiated, one social media post on Threatened Flora annually
9.2	Establish rare plants in the Barb Martin Bushbank botanical garden				Samples of cultivated plants established in the Barb Martin Bushbank garden

4.1 Recovery Actions

Table 3: Summary table of the recovery actions, a brief description and the applicable objectives to be achieved.

Recovery Action	Action Description	Recovery Objectives Achieved
1	Survey and monitor	1, 2, 5, 6
2	Manage threat from herbivores	4
3	Manage threat from pest plants	4
4	Manage microhabitats	2, 3, 4, 6
5	Ex-situ cultivation and translocation	7, 8, 9

4.1.1 Survey and monitor

Surveying the woodlands for *Caladenia vulgaris* and *Wurmbea uniflora* should be carried out during the flowering season in late spring to determine exact locations of their presence, the current extent of the population sizes and their habitat requirements. Annual monitoring in spring should be carried out to measure population trends, impacts due to management practices and changes in threat levels. A Threatened Flora Map using 'Collector for ArcGIS' (Esri 2020) has been created for recording locations of threatened flora. This will form the basis of a surveying tool for the collection of floristic and environmental information and monitoring the changes.

A species-specific surveying design needs to be developed to accurately determine the current population size and structure of the Rhyll Wetland *Monotoca glauca* population and for further monitoring.

Figure 5: Self-seeded juvenile *M. glauca* plant emerging from dead brush (image: Susan Spicer)

4.1.2 Manage threat from herbivores

Observations have shown the greatest threat to *Monotoca glauca* appears to be browsing by Swamp wallabies. Annual targeted searches for natural recruitment throughout the *M. glauca* population should be carried out, subsequently protecting germinants with tree guards and monitoring their survival. *Monotoca glauca* has very fine roots and does not transplant well so protecting the naturally occurring seedlings is of higher priority and of greater advantage than relying on propagating in the nursery and planting out. Protection against browsing and monitoring the survival rate will also help determine if there are other factors contributing to the lack of plants developing to maturity.

A trial of constructing wallaby and rabbit exclusion fencing around some of the mature and senescing plants should be carried out to determine if this might also foster more natural recruitment.

With respect to *Wurmbea uniflora* and *Caladenia vulgaris*, the impact of grazing animals is unknown but assumed. The inconspicuous nature of *C. vulgaris* and *W. uniflora* most likely allows them some protection by being overlooked, particularly if there are more favoured food sources present, however there is likely to be a loss to some degree. Native herbivores should not be totally excluded from the habitat however, as they are essential in maintaining a low density of ground coverage.

To determine the impact of herbivores upon *C. vulgaris* and *W. uniflora*, a trial could be conducted where the effects of a wire cage placed over a patch of plants can be monitored. The cage must be regularly checked and maintained otherwise it may be detrimental to these plants. It could allow a greater growth of grasses and other groundcovers that may out-compete them, and an accumulation of leaf litter on the cage can also reduce the amount of light penetrating.

Figure 6: Leaf litter build up on neglected cage

The population of *C. vulgaris* in the Koala Reserve plantation is already within a wallaby and rabbit proof fence so it is important to maintain this fence and monitor for breaches. Evidence of breaches were noted in 2019 and rectified (S. Spicer pers. comm.), however regular checks should be maintained.

4.1.3 Manage threat from pest plants

Removal of pest plants impacting the 3 woodland species in accordance with the Nature Parks Weeds Management Strategy 2017 should be maintained including the following:

Table 4: Weed species threatening the 3 woodland species (H: high; M: medium; L: low).

Scientific Name	Common Name	Priority PINP 2017	Priority for Woodland RAP
Alium triquetrum	Angled onion	H	H
Anthoxanthum odoratum	Sweet vernal grass	L	M
Asparagus asparagoides	Bridal creeper	H	H
Asparagus scandens	Asparagus fern	H	H
Dipogon lignosis	Dolichos	H	H
Galium aparine	Cleavers	M	M
Pittosporum undulatum	Sweet pittosporum	M	H
Senecio jacobaea	Ragwort	H	H
Ulex europaeus	Gorse	H	H

The status of Sweet pittosporum and Sweet vernal grass should be raised to High and Medium respectively for the purpose of this plan. Sweet Pittosporum has a direct impact upon the *Monotoca glauca* population and should continue to be targeted for removal by cutting and applying herbicide.

Sweet vernal grass may impact the *Caladenia vulgaris* and *Wurmbea uniflora* populations if conditions favour its spread, so it needs to be closely monitored and, if necessary, removed or reduced by spraying with a grass selective herbicide in winter.

4.1.4 Manage microhabitats

4.1.4.1 Slashing

It is essential to ensure that as part of the Nature Parks Fire Plan, the Rhyll Wetland fire access track and South Plantation of the Koala Conservation Reserve are slashed post flowering season for *Caladenia vulgaris* and *Wurmbea uniflora* and during their dormancy period (see Appendix 1).

Vicflora (2020) lists the *W. uniflora* flowering period as September – January. Observations of the Phillip Island populations show peak flowering time of late October and early November. Similarly, Vicflora (2020) lists *C. vulgaris* flowering period of October – December. On Phillip Island this also peaks late October – November, however there are records for late September and mid-December. Therefore the optimum slashing period would be from late December to April. An inspection should be carried out prior to slashing in case there is unusually late flowering (see Appendix 1).

The *C. vulgaris* and *W. uniflora* appear to have benefited from the annual slashing of the track in December. However there have been some years when an early start to the fire season is predicted and slashing has occurred during peak flowering time. This has particularly been to the detriment of the *W. uniflora* with fewer numbers flowering on the track than was first reported by Doug Frood in 2008.

The largest subpopulation of *W. uniflora* recorded in 2018 was in an area that had previously been slashed as a turning bay but was not slashed in 2018. Thus it would appear that it would be advantageous for *W. uniflora* if the late December – April slashing regime was recreated beyond the track and expanded, creating larger patches of similar habitat. This should also be advantageous for *C. vulgaris* and reduce competition with Spiny-head mat rush (*Lomandra longifolia),* Austral bracken and Hop goodenia.

4.1.4.2 Fire

There are numerous factors that may be contributing to a lack of recruitment of *Monotoca glauca* other than predation by herbivores. These include fruit production and a lack of suitable disturbance to stimulate germination. Frood (2019) suggested some possible experimentation of burning some very small patches of vegetation with or without added seed and of trialling pre- treatment of seeds prior to sowing.

Small-scale burn trials for *Caladenia vulgaris* and *Wurmbea uniflora* could also be carried out to reduce competition with other vegetation, however it should be noted that the *C. vulgaris* main habitat tends to be damp with few fires and may be intolerant to high fire frequency (CVUNN 2020a).

4.1.4.3 Raking

The populations of *Caladenia vulgaris* in the Koala Conservation Reserve and Ventnor Koala Reserve appear to have the most ideal habitat, that is an over story of Eucalypts with a very light leaf litter layer and a sparse density of grass and other groundcovers. Monitoring leaf litter volumes post summer and reducing the leaf litter density by localized raking in autumn may be required to maintain the optimum conditions in these locations. It is important not to disturb them by raking once they emerge from dormancy around May (Frood 2019).

Frood (2019) also recommended collecting seed of the *Wurmbea uniflora* and gently scratching it into the soil surface. He notes that to simply scatter the seed, most if not all would be predated by ants.

4.1.4.4 Maintain the woodland canopy

Fostering the care of the canopy species by protecting self-seeded *Eucalyptus* species, Black wattle (*Acacia mearnsii*) and Sweet bursaria with wallaby proof treeguards is required to help restore the optimal light conditions.

4.1.5 Ex-situ cultivation and translocation

As with many Australian heaths (Ericaceae), *Monotoca glauca* is very difficult to grow by seed. It is recommended by the Conservation Volunteers Understorey Network Nursery (2020b) to use the fermentation method, but germination can still take up to 18 months. It would be worth attempting to grow from seed but to also propagate by cuttings, having had some success with cuttings in 2009 (S. Spicer pers. comm.) using a heat tray. The great challenge then is planting out without disturbing the roots, protecting the young plants against grazing animals and watering them throughout dry periods until they are well established.

These cultivated plants can be planted back into the existing populations to enhance their demographic makeup, but new populations should also be established in other suitable sites using some of the cultivated stock. The eastern side of Cape Woolamai is a potential location to establish a new population as there is EVC Damp Sands Herb-rich Woodland present. A new population here would also be of benefit to Crimson berry (*Leptecophylla oxycedrus*) populations at Cape Woolamai that are also a threatened species. At Wilsons Promontory the two species grow together so an addition of *Monotoca glauca* to the Cape Woolamai Crimson berry habitat will help enrich and support the vegetation community and assist in attracting insect pollinators and frugivorous birds to aid seed dispersal.

The effort required for the cultivation of ground flora such as *Caladenia vulgaris* and *Wurmbea uniflora* in the nursery would be deemed quite large and of little value considering the species persistence in-situ in the woodlands. It is a specialist field of plant propagation and a particular mycorrhizal fungus is required for the *C. vulgaris* to germinate, so collection and cultivation of the fungus would also be required (CVUNN 2020a; CVUNN 2020c).

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Appendix

Appendix 1: Woodland flora life cycle and management practice timing Gantt chart