BEACONSFIELD RESERVOIR FLORA SURVEY AND VEGETATION MAPPING

Prepared for Melbourne Water

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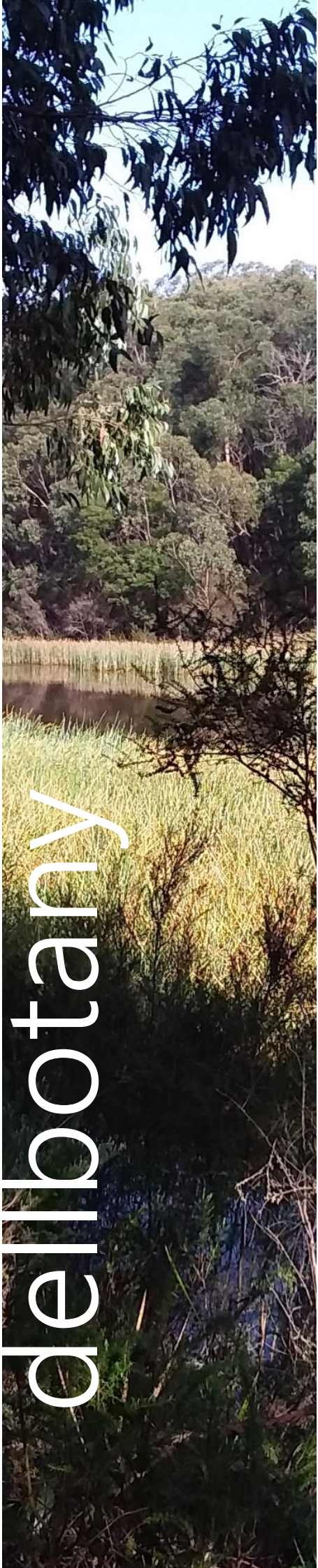

Beaconsfield Reservoir flora survey and vegetation mapping

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Prepared for Melbourne Water Corporation

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ACKNOWLEDGMENTS

This report has been commissioned by and prepared in consultation with Finn Adamson, Victor Gilevitis and Sian Conn — Melbourne Water Corporation. Dr Lisa Crowfoot (Dellbotany) reviewed the preliminary draft report. The authors acknowledge the Bunurong people of the South-Eastern Kulin Nation as traditional custodians of the land which was visited and surveyed during this assessment.

Summary

In 2010, a safety assessment at Beaconsfield Reservoir identified several stability and filtration failures requiring works to mitigate associated risks. Following a review of design options and public consultation, the partial decommission of the reservoir is now approved and includes the slow drawdown of the water-level over 3–5 years, to approximately 4 m below the current watermark. To identify potential impacts of this drawdown on the ecological values of the reservoir and surrounding Beaconsfield Reservoir Nature Reserve, the Arthur Rylah Institute for Environmental Research (ARI) and Dellbotany conducted a joint preliminary flora and fauna assessment of the site, focused on an area approximately 50 m from the reservoir. This report identified several threatened flora species likely present on site that could be impacted if present by the drawdown. It was recommended that further surveys and a more detailed assessment was undertaken prior to any works.

This (current) report provides a detailed assessment of the flora and native vegetation and includes the results of a general flora survey, targeted searches for threatened flora and mapping of Ecological Vegetation Classes (EVCs) within 20 m of the reservoir. Seven EVCs were mapped and two threatened plant species were recorded within this area: *Senecio campylocarpus* Floodplain Fireweed and *Eucalyptus fulgens* Green Scentbark. Following targeted surveys and examination of habitat types, three additional FFG Act listed flora species were identified as having moderate to high likelihood of presence, and a high relative risk of being directly impacted if present by the water drawdown. These comprise *Bossiaea cordigera* Wiry Bossiaea, *Isolepis wakefieldiana* Tufted Club and *Pomaderris vacciniifolia* Round-leaf Pomaderris — all threatened species known to occupy riparian vegetation elsewhere in at least part of their range. No flora species listed under the EPBC Act were recorded during the current assessment. No communities listed under the FFG Act or EPBC Act were recorded during the current assessment.

An estimation of native vegetation losses and gains was undertaken based on modelled strategic biodiversity values, modelled habitat for state listed (threatened) species and EVC mapped during the field assessment. A total of 1.551 ha of native vegetation would likely be temporarily lost. This equates to 0.534 general habitat units and 1.495 species units for Red-tip Greenhood *Pterostylis clivosa* (syn *Pterostylis* sp. aff. *parviflora* (Southern Victoria). Gains in areas that will be no longer inundated include. This equates to 0.35 general habitat units over approximately 3.3 ha which has a strategic biodiversity value of 0.325. It also includes species habitat units for six species (five plants and one fish) of between 0.469 and 0.528.

It is recommended that biodiversity values are carefully monitored during the drawdown process. This should include the preparation of a monitoring plan with targets for the management of ecological values and threats, as well as reporting requirements over three and ten years.

1. INTRODUCTION

Beaconsfield Reservoir is located on Haunted Gully Creek in Officer (Victoria) and was constructed in 1918 to supply water to the Mornington Peninsula (Battin, 2018, GHD 2019). Initially water was diverted (via aqueducts and tunnels) from Toomuc Creek, then as demand increased, water was taken from Bunyip River via the Bunyip Main Race, and later from Tarago River via the Tarago Main Race. In 1988, following the connection of Cardinia Reservoir to Melbourne's water supply and distribution network, Beaconsfield Reservoir was permanently disconnected from the system. While Beaconsfield Reservoir is managed by Melbourne Water, the land surrounding the waterbody is Crown Land managed by the Department of Environment, Land, Water and Planning (DELWP) (Melbourne Water 2021a).

In 2002, Biosis Research Pty Ltd undertook a flora and fauna survey of the land surrounding the reservoir for potential development purposes and found that the site had at least state, and likely national significance (Mueck et al. 2002). In relation to flora, one species of state significance, Green Scentbark *Eucalyptus fulgens*, was recorded on site and several other flora species of state or national significance were also considered likely to be present. The report concluded that, with regard to development potential, ecological constraints over the whole site would likely be high to very high. In 2005, the native vegetation surrounding the reservoir became Beaconsfield Nature Conservation Reserve (BRNR), managed by the Cardinia Environment Coalition (CEC) under an agreement with the Minister for Water (CEC 2022). Covering an area of 172 ha, BRNR is predominantly native vegetation and is managed to conserve its flora and fauna values. Though public land, BRNR is not currently publicly accessible, with access to the public limited to occasional open days and one-off events for interest groups (e.g. field naturalist clubs; Melbourne Water 2021a).

In 2010 URS (now AECOM) performed a risk assessment of Beaconsfield Reservoir and found that the 'dam' failed several modes including embankment stability and filtration (GHD 2019). A number of option-design reports followed (summarised in GHD 2019), alongside public consultation (summarised in Melbourne Water 2021b), with the partial decommission of the reservoir now approved to manage the stability and filtration risks (Melbourne Water 2021a). This will include the slow drawdown of the water-level over three–five years (Melbourne Water 2021a), to approximately 4 m below the current watermark (GHD 2019) and the lowering of the reservoir wall, approximately 4.5 m below its current height (Melbourne Water 2021a).

To identify potential impacts of this drawdown on the ecological values of the reservoir and surrounding Beaconsfield Reservoir Nature Reserve, the Arthur Rylah Institute for Environmental Research (ARI) and Dellbotany conducted a joint preliminary flora and fauna assessment of the site, focused on an area approximately 50 m from the reservoir (Shelley et al 2021). This report identified several threatened flora species likely present on site that could be impacted if present by the drawdown. It was recommended that further surveys and a more detailed assessment was undertaken prior to any works.

The current assessment has the following objectives:

- Undertake a general survey of flora species within 20 m of the reservoir.
- Undertake a targeted survey for threatened flora species within 20 m of the reservoir. Map the locations of any threatened plants observed.
- Provide detailed mapping (1:1000) and descriptions of EVCs observed.
- Provide a detailed risk assessment for threatened species and communities
- Provide mapping of other features – other ecological values or threats within 20 m of the reservoir (more widely if significant).

- Provide information on relevant planning.
- Identify how to mitigate risks to native vegetation and threatened flora.
- Provide a strategic assessment of losses and gains in native vegetation and associated threatened species habitats as a result of the proposed action.
- Provide advice on offsetting processes and whether offsets require further consideration.

2. METHODS

2.1 Study area

The study area comprises Beaconsfield Reservoir and the surrounding forested areas totalling 172 ha (Beaconsfield Nature Conservation Reserve - BNCR), with a focus on 20 m upslope from the current water-level (Figure 1). Beaconsfield Reservoir is in the suburb of Officer, approximately 45 km south of Melbourne, within the Cardinia Shire. The reservoir is on Haunted Gully Creek and lies within the Highlands Southern Fall bioregion and the Port Phillip and Westernport Catchment Management Authority (CMA). The reservoir has an average annual rainfall of approximately 1020.5 mm (Beaconsfield Upper) and an average annual temperature of 16.9 deg. C (Ferny Creek; BOM 2022).

2.2 Database searches

Prior to undertaking the flora survey, a list of significant plant taxa was compiled from a search of the Victorian Biodiversity Atlas (VBA) for records of threatened plants previously recorded within 2 km of the reservoir (DELWP 2021a). Threatened species are those listed as state threatened under the *Flora and Fauna Guarantee Act 1988* and nationally threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. A separate 5 km search was undertaken to identify any addition taxa previously recorded within the broader landscape, that may have habitat within BNCR.

An EPBC Act Protected Matters Report (DAWE 2021) was generated for the same 5 km search area. This report identifies listed species, communities and other matters of national environmental significance which may occur within the search area. This list was combined with the list generated from the VBA and the combined list was reviewed to determine the validity of taxonomic concepts and potential erroneous records (e.g. spatial errors).

Following the review of data quality, a unique list of taxa was produced and used as a list of candidate taxa for targeted surveys. Consideration was also given to published information about habitat preferences in VicFlora (2021) and some other sources. An additional search of the Atlas of Living Australia (ALA) was undertaken for the same search area, in a bid to add any additional taxa which have a different source to the VBA. NatureKit (DELWP 2021b) was accessed for modelled EVC mapping and other relevant spatial data.

2.3 Field surveys

The general flora survey, EVC mapping and targeted searches were undertaken on 21st October and 26th November 2021. An observed flora species list was generated for the study area and EVCs were mapped. Targeted searches were undertaken for threatened flora species and locations were recorded when observed. Notes were made about potential habitat for threatened flora species and observations related to potential threats were also recorded.

2.4 Data collection

Spatial data for threatened species were collected using the Android app Memento on a Samsung Galaxy tablet. A custom library was built to allow the co-ordinates of each plant taxon detected, a quantity category and date of record. A complete list of the Victorian flora was added from the Victorian Biodiversity Atlas to the Memento library, to ensure that current names and taxonomic concepts were being entered. The tablet uses a standard GPS and is prone to the usual spatial error for this type of GPS (usually +/- 7 m). It was found that in some locations, the GPS error may have increased. Spatial data were checked once downloaded to rectify any such errors; however, these were few and did not significantly affect the results of the mapping.

2.5 GIS

Mapping of EVC polygons, point locations for threatened species and observations of other values and threat was undertaken in the field using QField v.1.9.6 and SW Maps. Map figures were produced with QGIS v3.6. Final layers are in GDA94.

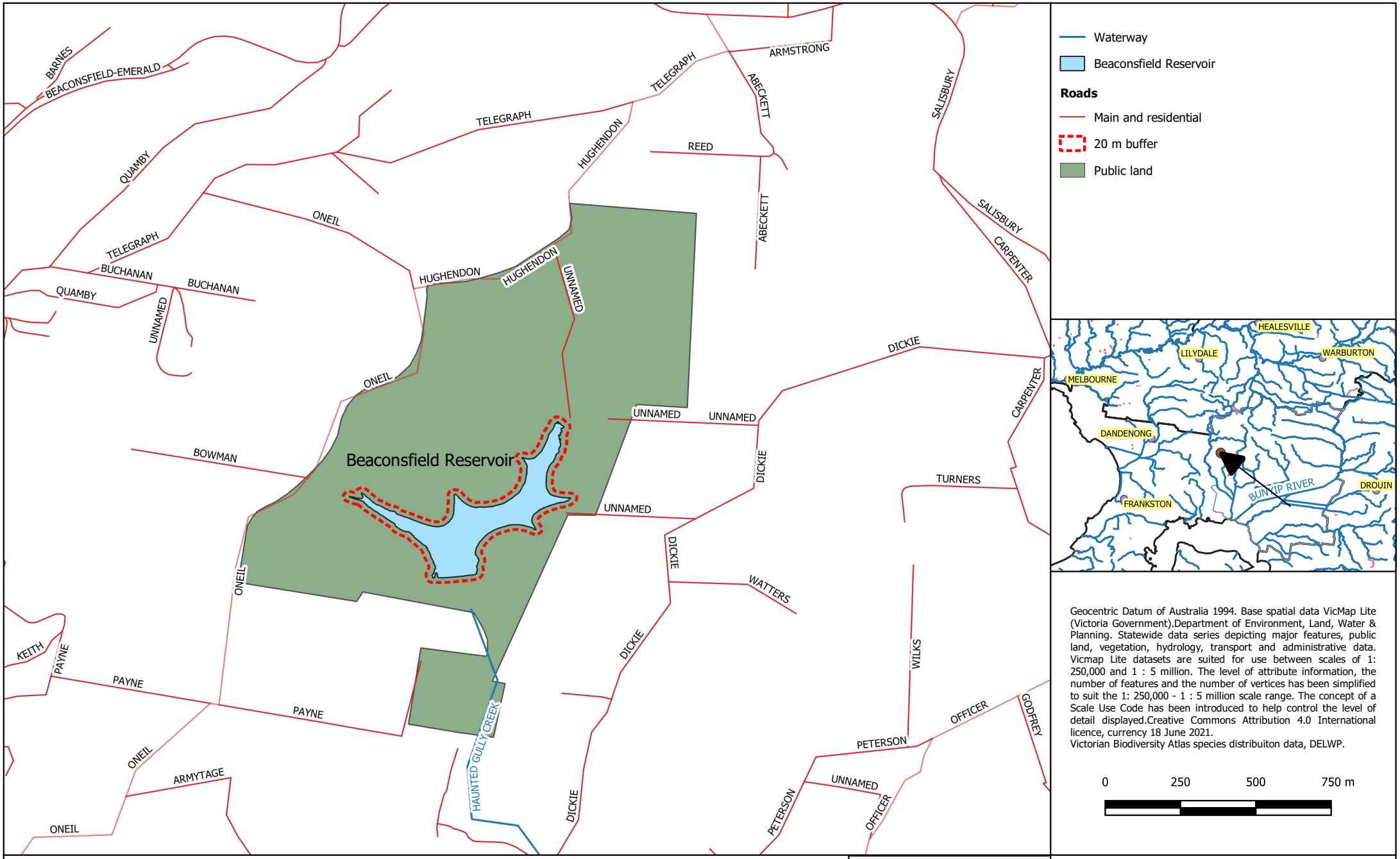

Figure 1. Beaconsfield Reservoir, study area

Drawing MW0222-1

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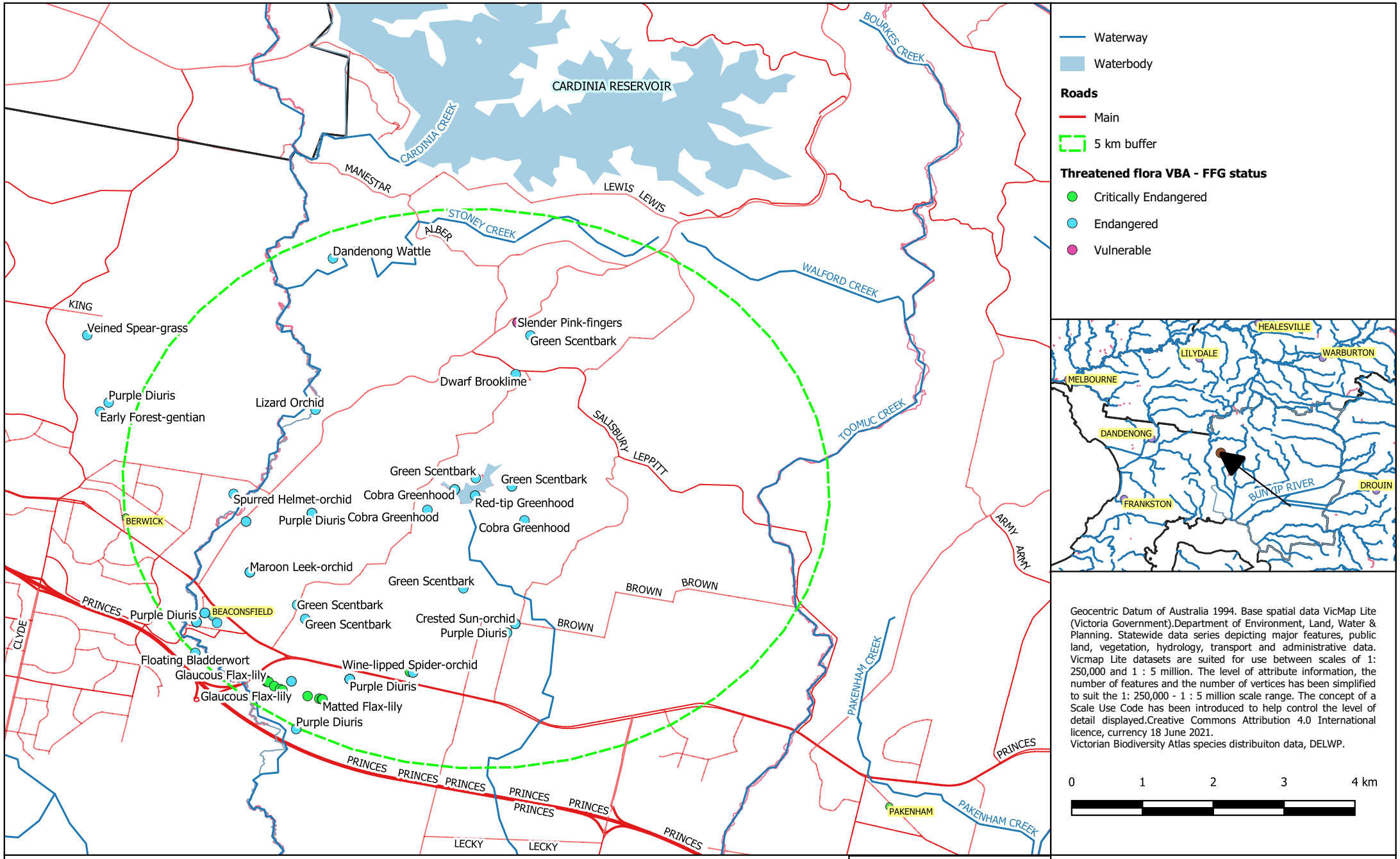

Geocentric Datum of Australia 1994. Base spatial data VicMap Lite (Victoria Government).Department of Environment, Land, Water & Planning. Statewide data series depicting major features, public land, vegetation, hydrology, transport and administrative data. Vicmap Lite datasets are suited for use between scales of 1: 250,000 and 1 : 5 million. The level of attribute information, the number of features and the number of vertices has been simplified to suit the 1: 250,000 - 1 : 5 million scale range. The concept of a Scale Use Code has been introduced to help control the level of detail displayed.Creative Commons Attribution 4.0 International licence, currency 18 June 2021.
Victorian Biodiversity Atlas species distribuiton data, DELWP.

Figure 2.VBA threatened flora records.

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2.6 Assessing risks related to the water-level drawdown on threatened plants

2.6.1 Site level risk assessment for threatened species

A risk assessment has been undertaken to provide a measure of relative risk to threatened taxa as a result of drawdown on the reservoir. The assessment aims to assist ranking statutory risk and conservation risk for each taxon. It includes several other factors which contribute to these risks, outlined in the following.

Candidate taxa for the risk assessment are those which are listed on the Threatened List (DELWP 2020) and have been recorded at any time within the study area, plus a 10 km radius, or have been observed during the current assessment within the study area. Note that species in Figure 2 represent those from within 5 km while the risk assessment considers records also at the 10 km scale, for those taxa.

The **Conservation status** (C) of each taxon was ranked according to their listing under the *Flora and Fauna Guarantee Act 1988*. Values used were 0 — not listed, 0.25 — conservation dependant (not applicable to flora), 0.5 — vulnerable, 0.75 — endangered, 1 — critically endangered.

The **Extinction risk** (Er) of each taxon was ranked according to their listing under the Threatened List (DELWP 2020). Values used were 0 — not listed, 0.33 — FFG listed and not endemic to Victoria, 0.66 — FFG listed and endemic to Victoria, 1 — EPBC Act listed.

Probability of presence (p) was estimated between 0–1 independently by two botanists. The objective of this element is to provide an average probability based on the subjective professional opinion of two or more botanists. It is required to account for a range of factors which influence presence and allows for a consistent rating regardless of the outcome of surveys aimed at determining whether a taxon is present. There is always some level of uncertainty in attempting to demonstrate absence of a taxon. The rationale in providing the probability estimate is not required for the assessment and is undertaken blindly by each assessor. The confidence level (c) of each botanist was also recorded (0–1) to contribute as a factor to overall risk. The inclusion of confidence allows for uncertainty in components of the risk assessment where heuristic decision-making is derived from and relies upon a range of empirical evidence, which inherently varies between assessors. Risk increases as differences in opinion on presence and confidence widens between assessors. Probability of presence values provide an estimate of the likelihood that a threatened plant taxon may be present at a site when not recorded. It takes into consideration the species' distribution, habitat and other factors such as ease of detecting (e.g. large tree versus annual herb), flowering times and confidence levels. Threatened plant taxa that were observed on site receive a probability of presence of 1.0.

Database records (D) were assessed as evidence of other observations of threatened taxa within the study area and surrounds. Records were obtained from the Victorian Biodiversity Atlas. A score was provided as a factor in the risk calculation according to Table 1. Database records were reviewed for the type of record (vouchered versus observations) and their reliability.

Table 1. Factors for number of database records and their distance from the study area

Maximum radius from study area	Total number of records	Time since last record				
		<5 yrs	6–10 years	11–20 years	20+ years	200+ years
10 km	<5	0.5	0.25	0.25	0.25	0
10 km	5 to 20	0.5	0.5	0.25	0.25	0
10 km	>20	0.5	0.5	0.5	0.25	0
5 km	<5	0.75	0.75	0.5	0.25	0
5 km	5 to 20	1	0.75	0.75	0.5	0
5 km	>20	1	1	0.75	0.75	0

Exposure (Ep) was ranked which provides an estimate of the level of risk to a taxon based on the consequence of its ecological susceptibility to the activity being considered (Table 2). Susceptibility is varied between taxa and depends on the type of activity. This element is ranked by a senior botanist and requires consideration of various factors. For example, a listed taxon may have multiple recent records within 0.5 km of the study area, but is confined to brackish wetland which is absent from the site being impacted. It therefore takes into consideration habitat on a micro scale but also an estimate of the level of resilience to impacts from the activity.

The standard deviation (σ) of probability of presence contributes to risk with the rationale that greater variation in expert judgement introduced additional risk in assessments. There are a range of complex considerations which affect expert judgement. Differences in opinion are an indication of greater uncertainty when providing an estimate of whether a taxon is likely to occupy a site (due to interpretation of habitat suitability, landscape composition, level of experience with the taxon etc). When a taxon has been observed by a both botanists within the assessment area, probability of presence is 1 and standard deviation is zero.

Table 2. Factors for levels of exposure to taxa

Exposure	Definition
0	No action or activity
0.25	Population predominantly isolated from primary and secondary impacts
0.5	Populations with small–moderate chance of secondary impacts only
0.75	Populations with moderate–high chance of secondary impacts OR low chance of primary impacts
1	Populations with moderate–high chance of primary impacts

A primary impact applies when at least part of the population is physically removed, displaced, buried or other loss in direct contact with an action. A secondary impact applies when at least part of the population is lost due to processes which follow an action e.g. sedimentation, changes to hydrology, exposure, change to soil conditions, plausible introduction of high threat weeds or pathogens, loss of symbiotic partner etc. For secondary impacts, populations are retained immediately following the action, but are highly likely to be impacted in time after as a direct result of the project (short or long term).

Risk (R) to a taxon was calculated by:

$$\mathrm{R} = (\mu p \times \mu \mathrm{c}) + (\mathrm{C} \times \mathrm{Er}) + (\mathrm{D} \times \mathrm{Ep}) + \sigma p$$

Relative risk (Adjusted z_i) is provided as follows, using zero as the minimum adjusted value so not to imply zero risk for any of the taxa assessed. That is, some residual risk to a taxon, even if negligible, is assumed on the basis that candidate taxa have qualified for consideration in the first instance, due to their occupancy in the landscape.

$$\text{Adjusted } z_i = \frac{\text{R}}{\max(\text{R})}$$

Relative risk is provided for management purposes. It should be used as a tool to determine the risk that an action will contribute to a loss of populations and, in some applications, the risk that a statutory breach may occur. The latter element of risk requires a further examination of planning matters and does not inherently consider what actions are permitted.

Relative risk is a measure to identify the risk of an adverse impact to a threatened plant species as the result of an action. Factors considered for relative risk include the likelihood of presence, risks associated with species preferred habitat type, extinction risk associated with state and national listings, likelihood of a direct or indirect impact from the proposed action and so on.

A certain level of risk may remain, even after site assessments and targeted surveys have been completed. This accounts for uncertainty in some components of an assessment and limitations which may be inherent or unavoidable at the time of survey. One of the main areas of uncertainty is attributing habitat types to taxa, including their level of use.

The difference in relative risk between taxa is more important than the value for each. For the purposes of this assessment, probability of presence and relative risk is divided into four categories:

- High probability of presence / relative risk = >0.75
- Medium probability of presence / relative risk = >0.50–0.75
- Low probability of presence / relative risk = >0.25–0.50
- Negligible probability of presence / relative risk = 0.00–0.25

Usually, threatened taxa with medium–high relative risk would be considered in detail. However, for Beaconsfield Reservoir, this would include over half (22/33) of all threatened taxa considered. This list is large, partly due to location; with a 5 km search from the reservoir expanding beyond the Highlands Southern Fall bioregion into the Gippsland Plain. We therefore focus on taxa more directly associated with the observed habitats and with >0.75 relative risk (high), to provide a local and more applicable context to this risk assessment. Consequently, plant taxa with either a high probability of presence or a high relative risk are discussed below, including a summary of factors weighing towards their score.

2.6.2 Strategic level risk assessment for state-level biodiversity values

An EnSym (Environmental Systems Modelling) assessment was undertaken to provide additional decision support for options to mitigate potential impacts to biodiversity (https://ensym.biodiversity.vic.gov.au/nvr_tool).

The EnSym calculations were based on the scenario that some areas of wetland EVCs would be temporarily lost. The scenario also included that the area between the current and proposed waterline (bank) would be re-established with native vegetation, by natural regeneration as well as intervention with revegetation and other restoration works. The EnSym scenario provides a number of calculations of the general biodiversity value in a statewide context and the impacts to threatened species. Two categories of modelled data are used to quantify impacts to Victoria's biodiversity: the Strategic Biodiversity Values (SBV) dataset and spatially-explicit predicted habitat models for a suite of

threatened species. A gain score of 0.16 was used to calculate gains, based on available gains on public land in DELWP (2017b). One limitation of using EnSym for this application is that large waterbodies such as Beaconsfield Reservoir tend to have lower modelled SBV values and lower habitat suitability values for terrestrial threatened species, over the waterbody area. The effect this has on the current simulation is that native vegetation around the current edge of water level has higher modelled values than areas where gains are expected to occur (currently under water). A standard assessment of losses and gains involving native vegetation removal using this method would be biased towards losses rather than gains. Despite this limitation, the simulation has been provided to demonstrate the approach to weighing up potential losses and gains to biodiversity, in addition to those described from the on-ground assessment. All aspects of the risk assessment should be used as multi-criteria decision support for the required planning processes.

2.7 Plant nomenclature and taxonomy

Plant nomenclature follows the Victorian Biodiversity Atlas (VBA). If a taxonomic concept disagrees with the online VicFlora (2021) then the concepts and names from VicFlora are used.

2.8 Limitations

October and November are considered an ideal time of year for detecting most plant taxa at Beaconsfield Reservoir and BRNR. However, some grasses and other taxa were either not fertile or insufficiently developed for reliable identification at the time of survey. This was also a problem for the identification of *Senecio campylocarpus* Floodplain Fireweed, a threatened species targeted as part of our survey. Though we found individuals with a habit and leaf morphology consist with this species, and occupying suitable habitat, we were unable to find fertile material that would conclusively confirm the presence of this species on site. Given the material examined fits several of the morphological and habitat characteristics of the species, we have determined these plants as Floodplain Fireweed. Despite the limitations, most target species (if present) could have been located using standard targeted survey methods. See Section 2.6.2 above for discussion on strategic level assessments of biodiversity impacts.

3 NATIVE VEGETATION VALUES AND THREATS

3.1 Ecological Vegetation Classes within 20 m of the reservoir

3.6.1 Aquatic Herbland

Aquatic Herbland occurs in narrow zones on the edge of some parts of the reservoir (Figure 3; Figure 10) Only larger patches have been mapped during this assessment. In the north-eastern arm, this EVC extends to cover a broader zone where there is a larger area of shallow water. The shallow water is accessed by deer and associated soil disturbance was observed. This is a derived community, which has formed its current composition and structure due to the construction of the reservoir. The most developed example of Aquatic Herbland comprises a moderate–high cover of aquatic herbs amongst less dominant tussocks of sedges and rushes. Characteristic species include *Isolepis inundata* Swamp Club-sedge, *Ranunculus amphitrichus* Small River Buttercup, *Alternanthera denticulata* Lesser Joyweed, *Centella cordifolia* Centella, *Crassula helmsii* Swamp Crassula, *Eleocharis acuta* Common Spike-sedge, *Gratiola peruviana* Austral Brooklime, *Schoenus apogon* Common Bog-sedge, *Lilaeopsis polyantha* Australian Lilaeopsis, *Lythrum hyssopifolia* Small Loosestrife, *Myriophyllum crispatum* Upright Water-milfoil, *Triglochin striata* Streaked Arrowgrass, *Hydrocotyle pterocarpan* Wing Pennywort, *Microlaena stipoides* Weeping Grass, *Juncus holoschoenus* Joint-leaf Rush, *Juncus subsecundus* Finger Rush, *Juncus planifolius* Broad-leaf Rush, with less common elements *Carex appressa* Tall Sedge, *Cycnogeton procerum* Common Water-ribbons, *Juncus amabilis* Hollow Rush, *Juncus gregiflorus* Green Rush and *Persicaria* spp. knotweeds. The FFG Act listed species *Senecio campylocarpus* Floodplain Fireweed (endangered) was recorded within this EVC during the current assessment. Typical weeds include **Cyperus eragrostis* Drain Flat-sedge, **Eurhynchium praelongum* Common Feather-moss, **Juncus articulatus* Jointed Rush and **Prunella vulgaris* Self-heal.

Bioregional conservation status — This EVC is not listed for the Highlands Southern Fall bioregion but is certainly threatened given its rarity in the bioregion. DSE (2012) notes that this EVC is widespread but rare in mountains and the north-west. It is listed as endangered in six out of seven of its occupied bioregions.

Figure 3. Aquatic Herbland example

3.6.2 Aquatic Sedgeland

This EVC occupies deeper water near the edge of the reservoir banks (Figure 10;

). There is often open shallow water between Aquatic Sedgeland and the bank, which may comprise Aquatic Herbland or a mix of ubiquitous native and weed species that are suited to regularly wet or shallow inundated clay soil. All this fringing vegetation is regarded as having developed since the reservoir was constructed. The dominant sedge is *Eleocharis sphacelata* Tall Spike-sedge and few other species occupy examples of this EVC at Beaconsfield Reservoir.

Bioregional conservation status — this EVC is not listed for the Highlands Southern Fall bioregion. It is moderately common in wetlands and larger dams.

Figure 4. One of the reservoir arms showing Aquatic Sedgeland

3.6.3 Riparian Scrub

Riparian Scrub at Beaconsfield Reservoir may be derived from changes to hydrology following the dam construction. Mature eucalypts are virtually absent from the mapped area (Figure 10; Figure 5). The EVC is otherwise dominated by medium to tall shrubs including *Leptospermum lanigerum* Woolly Tea-tree, *Leptospermum scoparium* Manuka, *Melaleuca e*ricifolia Swamp Paperbark, *Melaleuca squarrosa* Scented Paperbark, *Cassinia aculeata* Common Cassinia, *Coprosma quadrifida* Prickly Currant-bush,

Acacia dealbata Silver Wattle, *Olearia lirata* Snowy Daisy-bush and *Pomaderris aspera* Hazel Pomaderris. Patches with lower vegetation are dominated by ferns and large graminoids including *Blechnum minus* Soft Water-fern, *Blechnum nudum* Fishbone Water-fern, *Cyathea australis* Rough Tree-fern, *Hypolepis* sp. Ground Fern, *Todea Barbara* Austral King-fern, *Lepidosperma laterale* Variable Sword-sedge, *Juncus pallidus* Pale Rush, *Juncus procerus* Tall Rush, *Poa ensiformis* Sword Tussock-grass and *Lomandra longifolia* -headed Mat-rush. Several forb species occupy this EVC. *Microleana stipoides* Weeping Grass and bryophytes are dominant on the ground in many areas including *Thuidiopsis furfurosa* Golden Weft-moss. Weed cover is generally low and includes **Pseudoscleropodium purum* Neat Feather-moss, **Rubus anglocandicans* Common Blackberry and **Senecio jacobaea* Ragwort.

Bioregional conservation status — Vulnerable.

Figure 5. Riparian Scrub / Swampy Riparian Woodland complex from northwest side of reservoir

3.6.4 Swampy Riparian Woodland

Two patches of Swampy Riparian Woodland are recorded in the north-eastern and north-western arms of the reservoir (Figure 10; Figure 5) Though it is plausible that this vegetation is derived, it is also possible that this EVC was present in this area prior to the reservoirs construction but has since widened due to impeded draining around the inflow point (in the north-east) and slow drainage (in the north-west). The overstorey for this EVC consists of a variety of eucalypts including *Eucalyptus radiata* subsp. *radiata* Narrow-leaf Peppermint and *Eucalyptus ovata* Swamp Gum with an occasional *Eucalyptus cypellocarpa* Mountain Grey-gum. The midstorey is a mix of understorey trees and shrubs

including *Acacia dealbata* Silver Wattle, *Leptospermum lanigerum* Woolly Tea-tree, *Prostanthera lasianthos* Victorian Christmas-bush, *Ozothamnus ferrugineus* Tree Everlasting and *Coprosma quadrifida* Prickly Currant-bush. While the understorey consists of ferns (*Blechnum nudum* Fishbone Water-fern and *Hypolepis* spp. Ground Fern), gramnoides (*Lomandra longifolia* Spiny-headed Mat-rush, *Poa ensiformis* Sword Tussock-grass and *Microlaena stipoides* Weeping Grass), rushes (*Juncus pallidus* Pale Rush) and herbs (*Gratiola peruviana* Austral Brooklime).

Bioregional conservation status — Vulnerable.

3.6.5 Lowland Forest

Lowland Forest is the most widespread EVC which adjoins fringing vegetation around the reservoir (Figure 10; Figure 6). Its canopy is dominated by *Eucalyptus obliqua* Messmate Stringybark, *Eucalyptus radiata* subsp. *radiata* Narrow-leaf Peppermint with other species variably including *Eucalyptus cephalocarpa* Mealy Stringybark, *Eucalyptus dives* Broad-leaf Peppermint, *Eucalyptus fulgens* Green Scentbark (FFG Act endangered), *Eucalyptus goniocalyx* Bundy and *Eucalyptus ovata* Swamp Gum. Understorey vegetation is open and shrubby including *Acacia mucronata* Narrow-leaf Wattle, *Acacia verticillata* Prickly Moses, *Acacia m*earnsii Black Wattle, *Banksia marginata* Silver Banksia, *Epacris impressa* Common Heath, *Kunzea leptospermoides* Yarra Burgan, *Spyridium parvifolium* Dusty Miller, *Pultenaea gunnii* Golden Bush-pea, *Lomatia ilicifolia* Holly Lomatia, *Acrotriche prostrata* Trailing Ground-berry, *Tetrarrhena juncea* Forest Wire-grass, *Gahnia radula* Thatch Saw-sedge, X*anthorrhoea minor* Small Grass-tree, *Poa labillardierei* Common Tussock-grass and a suite of forb species. Weeds have low average cover and include **Acacia decurrens* Early Black-wattle, **Erica lusitanica* Spanish Heath, **Pittosporum undulatum* Sweet Pittosporum, **Ulex europaeus* Gorse and **Pseudoscleropodium purum* Neat Feather-moss. Bioregional conservation status — Least concern.

Figure 6. Lowland Forest and Green Scentbark habitat

3.6.6 Grassy Dry Forest

This EVC generally occupies west- or north-facing slopes and some ridgelines (Figure 10; Figure 7). It has a lower canopy height compared with Lowland Forest and a higher abundance of *Eucalyptus goniocalyx* Bundy and *Eucalyptus dives* Broad-leaf Peppermint. The understorey vegetation is conspicuously grassy with a variety of graminoid species including *Rytidosperma pallidum* Silvertop Wallaby-grass, *Themeda triandra* Kangaroo Grass, *Poa sieberiana* Grey Tussock-grass, *Lomandra multiflora* Many-flowered Mat-rush and *Dianella admixta* Black-anther Flax-lily. It is otherwise moderately rich in fobs (e.g. *Gonocarpus tetragynus* Common Raspwort, *Caladenia carnea* Pink Fingers, *Coronidium scorpioides* Button Everlasting and *Burchardia umbellata* Milkmaids) and small shrubs (*Hibbertia riparia* Erect Guinea-flower, *Platylobium obtusangulum* Common Flat-pea, *Acrotriche serrulata* Honey-pots and *Epacris impressa* Common Heath). Occasional midstorey trees and shrubs, encroaching from the adjoining Damp Heathy Woodland were also recorded in this EVC, such as *Exocarpos cupressiformis* Cherry Ballart *Hakea* spp. and *Acacia myrtifolia* Myrtle Wattle.

Bioregional conservation status — Vulnerable.

Figure 7. Grassy Dry Forest on the east side

3.6.7 Shrubby Foothill Forest

Some areas of forest on the south-western side of the reservoir have a very high shrub cover and notably different composition compared with other foothill forests observed (Figure 10;). It includes high cover-abundances of *Spyridium parvifolium* Dusty Miller, *Pultenaea hispidula* Rusty Bush-pea and other shrubs. There are affinities with this vegetation and Lowland Forest, but it is distinct enough to represent Shrubby Foothill Forest, which also occurs nearby to the north at Cardinia Reservoir. The area has also been burnt at some recent time and the high cover of shrubs may be product of this. This community is noted here mainly for the different habitat types it provides, with consideration to a threatened species this different habitat may contain.

Bioregional conservation status — Least Concern

Figure 8. Shrubby Foothill Forest on west side

3.6.8 Predominantly exotic vegetation

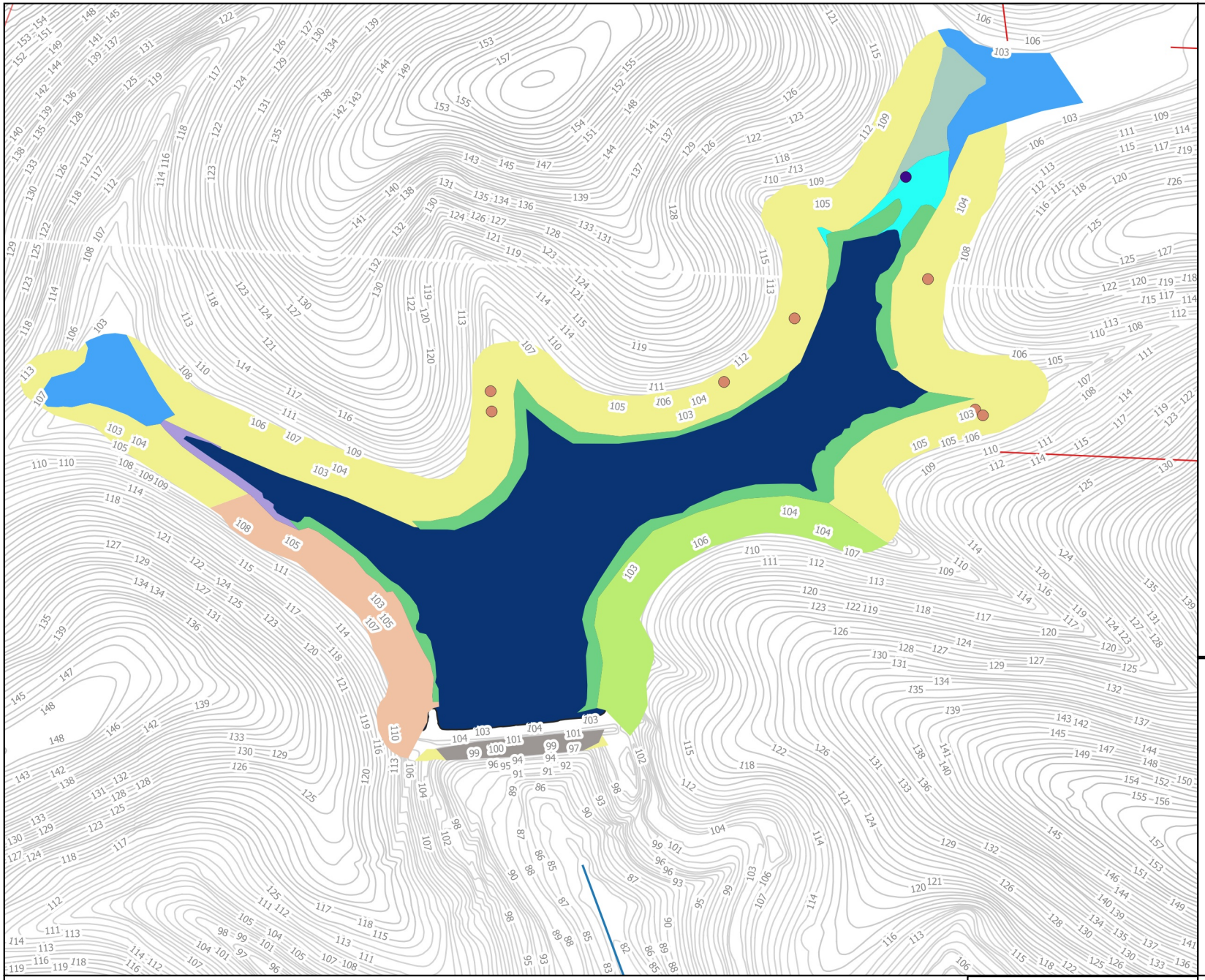
The southern side of the reservoir wall consists of predominantly exotic species interspersed with occasional native species which have recruited since construction (Figure 10). Consisting of a ground layer of grasses and other herbs, native species observed in this area included *Thelymitra* spp. sun-orchids, *Microtis unifolia* Common Onion-orchid, *Lomandra filiformis* Wattle Mat-rush and *Microlaena stipoides* Weeping Grass. Exotic species recorded on the wall include **Genista linifolia* Flax-leaf Broom, **Lactuca serriola* Prickly Lettuce, **Prunella vulgaris* Self-heal, **Trifolium dubium* Suckling Clover and **Plantago lanceolata* Ribwort. Of the exotic species, **Genista linifolia* Flax-leaf Broom is considered to have a very high risk to the environment (White et al 2018). Bioregional conservation status — NA for predominantly exotic vegetation.

3.3 Other Ecological Vegetation Classes within the broader area

3.6.9 Damp Heathy Woodland

Damp Heathy Woodland was observed uphill on the north-eastern side of the reservoir (Figure 10; Figure 9). The canopy was dominated by *Eucalyptus radiata* subsp. *radiata* Narrow-leaf Peppermint and *Eucalyptus cephalocarpa* Mealy Stringybark, with a sparce shrub layer of *Hakea decurrens* Bushy Needlewood and *Hakea ulicina* Furze Hakea, and an understorey dominated by *Austrostipa muelleri* with occasional *Gahnia radula* Thatch Saw-sedge. Though this vegetation does fit the description for Damp Heathy Woodland, it has an affinity with Lowland Forest. Mueck et al. (2002) did not consider this EVC to occupy BNCR. Though this EVC is located greater than 20 m from the reservoir, it is summarised here to provide information about the variation in vegetation types around the perimeter of the reservoir. Bioregional conservation status — Depleted

Figure 9. Area of Damp Heathy Woodland



Waterway

Beaconsfield Reservoir

Ecological Vegetation Classes

- Aquatic Herbland
- Aquatic Herbland / Aquatic Sedgeland
- Aquatic Sedgeland
- Grassy Dry Forest
- Lowland Forest
- Predominantly exotic vegetation
- Riparian Scrub
- Shrubby Foothill Forest
- Swampy Riparian Woodland

ThreatenedFlora

- *Eucalyptus fulgens*
- *Senecio campylocarpus*

Geocentric Datum of Australia 1994. Base spatial data VicMap Lite (Victoria Government).Department of Environment, Land, Water & Planning. Statewide data series depicting major features, public land, vegetation, hydrology, transport and administrative data. Vicmap Lite datasets are suited for use between scales of 1: 250,000 and 1 : 5 million. The level of attribute information, the number of features and the number of vertices has been simplified to suit the 1: 250,000 - 1 : 5 million scale range. The concept of a Scale Use Code has been introduced to help control the level of detail displayed.Creative Commons Attribution 4.0 International licence, currency 18 June 2021.
Victorian Biodiversity Atlas species distribuiton data, DELWP.

0 50 100 150 200 m

Figure 10. Ecological Vegetation Classes fringing reservoir / threatened flora observed

Drawing MW0222-10

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3.4 Potential threats to EPBC Act listed ecological communities

The Protected Matter Search Tool identified two EPBC Act listed ecological communities which may occur within the search area. These are:

- Natural Damp Grassland of the Victorian Coastal Plains
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Neither listed community is considered likely to occur, based on the definition criteria of each (DoE 2015, TSSC 2006) and observations of communities during the site survey for this report. Beaconsfield Reservoir does not fall within the landscape context of the former community, which is typically lowland plains. None of the characteristic eucalypt species occur for the latter community.

There were no FFG Act listed communities observed during the site survey. The area of Riparian Scrub (Figure 10) has similarities with the FFG Act listed community Sedge-rich *Eucalyptus camphora* Mountain Swamp-gum, currently known only from Yellingbo Nature Conservation Reserve. Many of the flora species are common however the Riparian Scrub at Beaconsfield Reservoir has a different hydrology and therefore does not develop the same composition and cover of sedges and other swamp species.

Despite this, the swampy areas at Beaconsfield Reservoir still have ecological significance for their rarity in the landscape and associated fauna habitats. One threatened species was observed in this Riparian Scrub (Floodplain Fireweed; Figure 10) and there is potential that this EVC contains others threatened species not observed during the site survey.

This assessment concludes that there are no listed ecological communities which are likely to be impacted by the proposed action.

3.5 Potential threats to Ecological Vegetation Classes and canopy trees

Aquatic Herbland and Aquatic Sedgeland have narrow extents on the margins of the reservoir and With Aquatic Herbland occupying the smallest area and being the most threatened EVC with regard to the proposed lowering of the water-level. It is possible that newly created areas of shallow water will provide replacement habitat for these EVC, however, in relation to Aquatic Herbland, it should not be assumed that this EVC will naturally establish in such areas. The depth of water and capacity for periodic drying is important for this EVC to establish and persist within suitable waterbodies.

Riparian Scrub and Swampy Riparian Woodland will also be impacted by lowering the water-level. Many of the shrub species which dominate these EVCs are common and readily recruit in areas of suitable habitat. Once the reservoir is lowered, the creation of new areas of Riparian Scrub and Swampy Riparian Woodland will likely follow. Flooding and waterlogging of soils on the inflow side of the dam will persist and will likely increase in extent if the margins have a lower gradient than previous. There is a moderate diversity of understorey plants in these EVCs, some of which may be slower to colonise new areas of habitat.

Dry foothill EVCs on lower slopes, including Lowland Forest, fringe most of the waterbody. It is expected that these vegetation types will recruit into areas of exposed earth following permanent lowering of the water-level, however monitoring would be required to determine the compositional changes which occur as a result. Some dieback of eucalypts may occur near the current high water-

level due to the rate of change to hydrology. Seed dispersal and germination however is not expected to be limited due to an abundance of fertile material near the bank. There are also several species which occupy the zone nearest the edge of the bank including *Eucalyptus obliqua* Messmate Stringybark, *Eucalyptus cephalocarpa* Mealy Stringybark, *Eucalyptus fulgens* Green Scentbark, *Eucalyptus radiata* Narrow-leaf Peppermint and *Eucalyptus ovata* Swamp Gum. This offers a level of redundancy in any one species' role to provide a tree canopy between the current and future high-water mark. Similarly, it is expected that a suite of understorey species will be suited to recruit in this space; either by vegetative spread or by seed. Regarding longer-lived perennials, it is expected that early successional species or those which are advantaged by disturbance will be dominant over the 10 years following including *Kunzea* spp. Burgan, *Leptospermum scoparium* Manuka and *Cassinia* spp.

Implications for impacts to trees warrant separate discussion due to their multiple ecological roles including habitat for fauna. Impacts should be considered in terms of changes to soil moisture, ambient humidity and related changes over a 3–5 year period as the water-level is lowered. It is not implied that this will lead to a water deficit in mature trees as most of these species are abundant also further upslope, away from the edge of the reservoir. Other factors such as soil instability may contribute to windthrow. Stress due to hydrological changes may also make some tree more susceptible to other pressures which may cause dieback.

The wider influence of drought (seasonal and long-term) is also a consideration and planning may take into account how these two factors interact. There is capacity for eucalypt species to vary physiological traits in response to drought and season. Such observations have been made for Messmate Stringybark with plasticity in traits attributed to some level of resilience against drought (Pritzkow et al. 2020). Messmate Stringybark has the capacity to adapt to long-term drought by changing morphological traits (Pritzkow et al. 2021). It is conceivable that trees closer to the reservoir edge are less resilient to future long-term drought, and that the combined effects of lowering the water-level and regional climate cycles may result in higher incidence of dieback in this zone. An analysis of stomatal conductance of six eucalypt species in central Victoria revealed that each species had a unique response to seasonal variation in climate, with *Eucalyptus melliodora* Yellow Box having the lowest level of photosynthesis rate relative to stomatal conductance and transpiration, and *Eucalyptus goniocalyx* Bundy having the highest across all seasons (Patykowski et al. 2019). As such, the responses of trees to lowering the water-level will likely vary depending on the species.

Tree recruitment in the zone between new and old high-water-levels has its own considerations. eucalypt seedlings will need to compete with other species including several woody weed species which occur around the reservoir. They will also need to endure summer conditions while still at seedling stage and with limited shade.

4 INFORMATION ABOUT THREATENED PLANTS

4.1 Updated summary of threatened plants recorded within 5 km of the site

In the preliminary report for this site, a list of threatened plants within 2 km and 5 km of the reservoir was provided. Table 3 is an adjusted version of this same list, modified to incorporate some of the findings discussed in the preliminary report. For example, several species identified as having a low likelihood of being present onsite are not listed in Table 3. Examples included *Asterolasia asteriscophora* subsp. *albiflora* White Star-bush and *Pterostylis cucullata* Leafy Greenhood. Several other species have been added to the list, having been identified as potentially present or having suitable habitat following additional searches since the preliminary report. Examples include *Pomaderris vacciniifolia* Round-leaf Pomaderris and *Discaria pubescens* Australian Anchor Plant. This revised Table 3 comprise 33 taxa of which 23 are state listed as threatened under the *Flora and Fauna Guarantee Act 1988* and two are nationally listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*.

Table 3. Revised list of threatened plants recorded within 5 km of the Beaconsfield Reservoir

Scientific Name	Common Name	FFG Act status	EPBC Act status	Year of last record	Source	Hydrological group	Probability of presence	Relative risk
Acacia stictophylla	Dandenong Wattle	En		2006	VBA	2	0.35	0.59
Austrostipa rudis subsp. australis	Veined Spear-grass	En		2003	VBA	2	0.40	0.48
Bossiaea cordigera	Wiry Bossiaea	En		2011	VBA	1,2	0.65	0.84
Burnettia cuneata	Lizard Orchid	En		1900	VBA	1	0.35	0.32
Caladenia maritima	Angahook Pink-fingers	Cr		2000	VBA	2	0.30	0.57
Caladenia oenochila	Wine-lipped Spider-orchid	Cr		2003	VBA	2	0.65	0.61
Caladenia vulgaris	Slender Pink-fingers	Vu		2004	VBA	2	0.30	0.43
Carex alsophila	Forest Sedge	En		1980	VBA	1	0.40	0.58
Correa reflexa var. *lobata*	Powelltown Correa	En		2014	VBA	2	0.40	0.76
Corybas aconitiflorus	Spurred Helmet-orchid	En		2008	VBA	2	0.30	0.55
Dianella amoena	Matted Flax-lily	Cr	En	2019	VBA,PMST	2	0.35	0.71
Discaria pubescens	Australian Anchor Plant	Cr		1999	VBA	1	0.05	0.35
Diuris punctata var. *punctata*	Purple Diuris	En		1986	VBA	2	0.20	0.38
Eucalyptus fulgens	Green Scentbark	En		2006	VBA	2	1.00	1.00
Euphrasia caudata	Tailed Eyebright	En		2005	VBA	2	0.10	0.26
Geranium solanderi var. *solanderi* s.s.	Austral Crane's-bill	En		2004	VBA	2	0.60	0.59
Glycine latrobeana	Clover Glycine	Vu	Vu	2003	VBA,PMST	2	0.45	0.70
Isolepis wakefieldiana	Tufted Club-sedge	En		2004	VBA	1	0.55	0.88
Olearia asterotricha	Rough Daisy-bush	En		1980	VBA	1,2	0.30	0.57
Pomaderris vacciniifolia	Round-leaf Pomaderris	Cr	Cr	-	PMST	1,2	0.55	0.79
Prasophyllum frenchii	Maroon Leek-orchid	En	En	2019	VBA,PMST	1,2	0.15	0.68
Pterostylis clivosa	Red-tip Greenhood	En		2011	VBA	2	0.50	0.81

Scientific Name	Common Name	FFG Act status	EPBC Act status	Year of last record	Source	Hydrological group	Probability of presence	Relative risk
Pterostylis chlorogramma	Green-striped Greenhood	En	Vu	-	PMST	2	0.45	0.49
Pterostylis grandiflora	Cobra Greenhood	En		2006	VBA	2	0.60	0.75
Pterostylis rubescens	Inland Red-tip Greenhood	En		2003	VBA	2	0.35	0.46
Pterostylis X *ingens*	Sharp Greenhood	Vu		1900	VBA	2	0.45	0.37
Pterostylis X *toveyana*	Mentone Greenhood	En		1900	VBA	2	0.10	0.36
Scleranthus fasciculatus	Spreading Knawel	En		1999	VBA	2	0.05	0.30
Senecio campylocarpus	Floodplain Fireweed	En		2021	VBA	1	1.00	0.70
Tetratheca stenocarpa	Long Pink-bells	En		1935	VBA	2	0.35	0.52
Thelymitra hiemalis	Winter Sun-orchid	Cr		2012	VBA	2	0.45	0.83
Thelymitra X *irregularis*	Crested Sun-orchid	En		1900	VBA	2	0.45	0.70

Hydrological group: **1** — occupies riparian areas, swamps or other areas where there is permanent or periodic inundation (seasonal or other) e.g. flood zones, dam edges and similar. **2** — terrestrial areas which are subject to rainwater runoff or drainage, but without accumulating surface water. FFG and EPBC statuses — Cr — Critically endangered, En — Endangered, Vu — Vulnerable. Source VBA — Victorian Biodiversity Atlas, PMST — EPBC Protected Matters Search Tool. Probability of presence is the average of two assessments, performed independently by two botanists and considered in part, the likelihood of a species being present, but not observed during the targeted searches. Plant taxa with a probability of presence of 1.0 were recorded on site during the targeted searches. Relative risk is the risk that lowering the reservoir water-level will have on the threatened plant taxa. Plant taxa with a high probability of presence or high relative risk (0.75+) are highlighted (blue).

4.2 Probability of presence and relative risk to threatened plant taxa

4.6.1 Threatened plant taxa observed

Two threatened plant species were observed within 20 m of the reservoir (probability of 1, Table 3, Figure 11).

Eucalyptus fulgens Green Scentbark — Several individuals of this state listed endangered species were recorded in Lowland Forest both north and south-east of the reservoir during targeted searches of the site. This species is not typically dependent on riparian zones or margins of waterbodies, however there is an indirect risk to this species associated with the reservoir drawdown, given it is presence within 20 m of the reservoir. It is plausible that this species may recruit to the newly exposed dry reservoir bank as the water-level lowers, though it is also possible that recruitment does not occur, or that this species becomes a loss because of hydrological changes.

Senecio campylocarpus Floodplain Fireweed — This species was recorded in the north-eastern Aquatic Herbland (Figure 10) during the targeted search of the site. The main threats to this species are changes to shallow inundated vegetation caused by lowering the water level. The proposed drawdown will alter habitat conditions and make existing areas of habitat unsuitable for occupancy. It is possible this species may recruit into any newly established Aquatic Herbland, as the water-level drops. Another significant threat to this species is deer trampling, as it grows in sites which were observed to be frequented by deer (with many tracks and pellets observed) and where wallowing is most likely.

4.6.2 Threatened plant taxa with a high probability of presence and relative risk

Seven threatened plant taxa were identified as having a high probability of presence and relative risk (0.75 or higher). These have the highest priority for planning consideration, in addition to the two observed species above (highlighted in Table 3). These species occupy a range of habitat types within 20 m of the reservoir, including drier communities such as Lowland Forest and Grassy Dry Forest. They have a higher relative risk due to their statutory listing (e.g. state or national level and threat status) and their likelihood of presence. It is plausible that changes to the hydrology in this 20 m zone (ground water) could result in a decline of these drier habitat species, and if no recruitment occurs, these may be lost. The more likely outcome is that either none of these drier habitat plants are lost during the drawdown, or some plants may be impacted, but others recruit onto the newly exposed bank. The exceptions are *Bossiaea cordigera* Wiry Bossiaea and *Isolepis wakefieldiana* Tufted Club-sedge, which all prefer wetter or riparian habitat types. These species are therefore at greater risk as a direct result of the drawdown and any associated drying out of fringe vegetation around the reservoir. Though it is possible that this wetter habitat may migrate to follow the edge of the water, it is also possible that a loss will occur.

Bossiaea cordigera Wiry Bossiaea — There is one record for this species within 5 km of the reservoir (VBA 2021) and it is state listed as endangered. The habitat requirements of this shrub are varied although it is usually associated with moist drainage lines or floodplains. It occurs in heathland, heathy woodland and open forest (VicFlora 2021). This shrub can reach 1.4 m high (VicFlora 2021) and has been observed previously by the survey team as a prostrate shrub (<10 cm high). It is therefore possible that, despite targeted searches for this species, it could be present on site but undetected during previous and the current survey. If present, it would likely be directly impacted by the lowering of the water-level. It is possible this species could recruit to the newly exposed reservoir bank, though it is also possible that this species could be lost. The recruitment requirements of this species are unclear.

Correa reflexa var. *lobata* Powelltown Correa — This shrub has been recorded within BNCR and there are three records elsewhere near Cardinia Reservoir from 2006–2014 (VBA 2021). It typically occupies moist open forests which are often heathy (VicFlora 2021). Such forest types occur within BNCR including vegetation within or on fringes of riparian zones (e.g. Lowland Forest). Given this species was not observed during the targeted searches and generally occupies forest vegetation, any impact on this species associated with the drawdown of the reservoir is likely to be indirect and limited.

Glycine latrobeana Clover Glycine — There are two records of this species within 5 km of the reservoir, both collected on the same day at a single location (VBA 2021). It is listed as vulnerable at both state and national levels and generally prefers drier grassland and grassy woodland habitat (VicFlora 2021). It may occupy Grassy Dry Forest and similar grassy vegetation within 20 m of the reservoir although it was not observed. Though it is possible this species is present on site (but not observed), any impact of the water-level lowering is likely minimal despite the risk.

Isolepis wakefieldiana Tufted Club-sedge — There is one record of this species within 5 km of the reservoir (VBA 2021). It is possible this species is at times overlooked due to its similarity with the common species *Isolepis inundata* Swamp Club-sedge (VicFlora 2021). Swamp Club-sedge was recorded during the current assessment, within the Swampy Riparian Woodland and elsewhere around the banks. Tufted Club-sedge is state listed as endangered and like most species of *Isolepis*, it is found in wet habitats like those recorded on site (e.g. Aquatic Herbland or Swampy Riparian Woodland). It is therefore possible that (if present) the drawdown of the reservoir may impact on this species, though it is also plausible that its associated habitat will migrate with the lowering water-level.

Pomaderris vacciniifolia Round-leaf Pomaderris — While there are no observations of this species within 5 km of the study area, it is known from the region and prefers moist forests and scrub (VicFlora 2021), like those mapped within BNCR. Listed as critically endangered at both state and national levels, it is plausible that this species could be present within BNCR, in the seed bank or as supressed immature plants. Riparian Scrub, Swampy Riparian Woodland and some areas of Lowland Forest are suitable habitat. There is a risk that if present, the drawdown of the water-level could impact this species. The absence of observations from the current survey indicate that an undetected population would be a marginal and minor component of its total population. Any inadvertent impact would not alter the species' total extent of occurrence or currently documented area of occupancy. It would also therefore not be considered a significant impact if found to be present.

Pterostylis clivosa Red-tip Greenhood — This orchid occurs on well-drained soils, on slopes and ridges in drier open forests and woodland (VicFlora 2021). There are at least two reliable records of this species in the local area (VBA 2021) and it is listed as state endangered. Red-tip Greenhood flowers from March–June (VicFlora 2021), so while spring is generally the optimal time for targeted searches of most flowering plant species, this species would have been difficult to detect and identify in October–November. While it is possible this species could be found within 20 m of the reservoir, any impact of the water-level lowering would be indirect and limited.

Thelymitra hiemalis Winter Sun-orchid — This species is listed as state critically endangered and there is one recent (2012) record of this species on private property within 5 km of the reservoir (VBA 2021). It prefers heathland and heathy woodland on well-drained soils and flowers in winter. Given the targeted searches occurred outside this species flowering time it is possible it is present but was unable to be detected. As it prefers well-drained soil, it is likely to be more common outside 20 m from the current water-level. If present any impact on this species would likely be indirect and minimal.

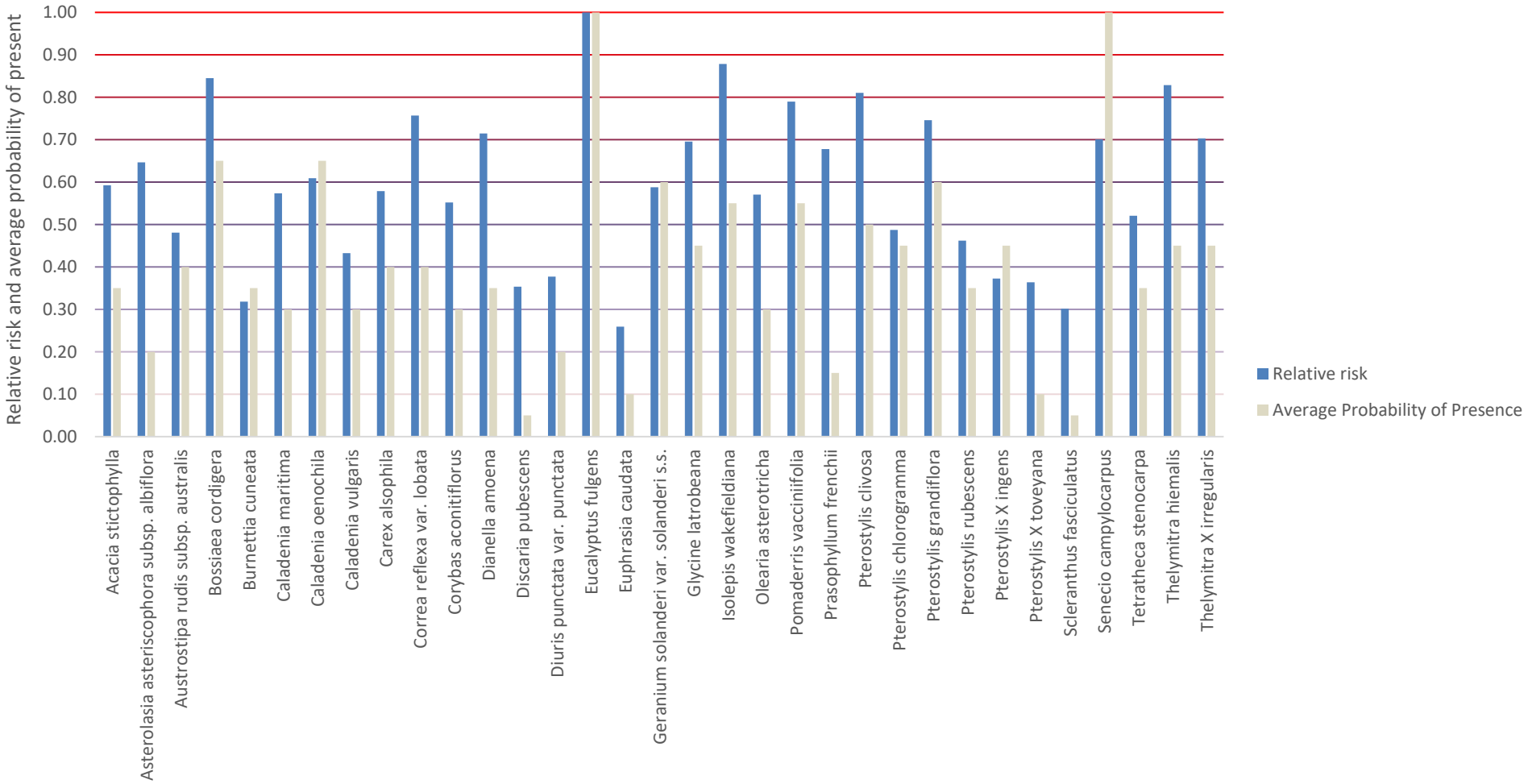


Figure 11. Average probability of presence and relative risk for threatened plants within the study area

5 LEGISLATION

5.1 The Planning Scheme and Permitted Clearing Guidelines

5.6.1 Planning context

The removal, destruction and lopping of native vegetation is regulated in all Victorian planning schemes under Clause 52.17 (and Clause 52.16 although only relevant to Precinct Structure Plans). Methods for quantifying associated losses to biodiversity are described in DELWP (2017) — which is an incorporate document in all planning schemes — and referred to hereafter as the Guidelines. Other clauses in the planning scheme may require further permit considerations for impacts to native vegetation (and biodiversity) e.g. overlays. The current application requires consideration of permit requirements for removal of native vegetation because there will be some unavoidable losses in native vegetation as a result of lowering the water-level in the reservoir. An assessment of permit requirements under Clause 52.17 is given further discussion below. Permit considerations aside, planning policy in Victoria (Clause 12.01, Protection of Biodiversity) requires that the Guidelines are considered as a minimum. Planning for any change in land use and development must take into account the impacts to Victoria's biodiversity. Clause 12.01 has the objective of no net loss to biodiversity caused by the removal, destruction or lopping of native vegetation. Decisions that lead to the removal, destruction or lopping of native vegetation must demonstrate that the losses have been avoided, minimised and offset. Information held by DELWP, such as threatened species records and strategic models, should be considered in any application.

Under Clause 52.17, a permit is required to remove, destroy or lop native vegetation, including dead native vegetation. A suite of exemptions apply (52.17-7) to this permit requirement. Some exemptions may be relevant to the current application depending on the actions. Melbourne Water should seek further advice from DELWP regarding relevant permit requirements. Some of the exemption which may apply are described:

Conservation work — if Victorian native plants as defined under the planning scheme are being removed for conservation reasons, and are not otherwise exempt from requiring a permit a schedule in 52.17, then a conservation works permit exemption may be sought. The removal must result in an overall improvement in biodiversity and be agreed to by DELWP. Within Cardinia Shire, *Pittosporum undulatum* Sweet Pittosporum does not require a permit for removal.

Dead native vegetation — a permit is not required to remove dead vegetation unless it is a standing dead tree with a trunk >40 cm diameter, or taller than 1.3 m above the ground.

Regrowth — native vegetation that has naturally established or regenerated on land lawfully cleared less than 10 years ago may be exempt from requiring a permit.

Utility installation — native vegetation may be removed, destroyed or lopped to minimum extent necessary to maintain the safe and efficient function of a minor utility installation, or by a utility service provider to maintain or construct a utility installation in accordance with an agreement from DELWP. Clarification on the use of this exemption is provided by DELWP (2020). The reservoir may exceed the definition of a minor utility under Clause 73.03. The reservoir would be considered a utility installation under Clause 73.03 as land use to collect, treat, transmit, store or distribution water. If an exemption to requiring a permit under Clause 52.17 applies, there is no requirement to quantify losses and gains for the purpose of offsetting native vegetation under this clause.

5.6.2 Planning overlays

Beaconsfield Reservoir and surrounding land (Allot. 2012 Parish of Pakenham) is subject to an Environmental Significance Overlay (Schedule 1) (ESO1) and includes the area of the Beaconsfield Reservoir water body. Under ESO1 a permit is required to remove, destroy or lop any vegetation including dead vegetation, unless an exemption applies. The exemptions under Clause 42.01-3 and Schedule 1 should be examined carefully by a planner during the application stage. Environmental weeds under exemptions for vegetation removal under Schedule 1 include a number of species which were recorded as occurring within 20 m of the reservoir body. Their exemption as it relates to a permit under Clause 42.01 does not replace the permit requirements of Clause 52.17, which may affect some of these species. For a permit application under Clause 42.01, the application requirements and decision guidelines must be addressed. This includes (amongst other considerations) a written response as to how the native vegetation removal has been avoided, minimised and appropriately replaced and/or compensated. Associated impacts must consider how areas of remnant vegetation, habitat of botanical and zoological significance and threatened species are impacted. The current report contributes to addressing these considerations.

5.6.3 Strategic assessment of losses and gains to biodiversity

The standard approach for a detailed state-level assessment of impacts to biodiversity (DELWP 2017) involves a strategic component plus a component based on the assessment of observed values at a site. Quantifying native vegetation losses for this application is not straight forward. There is no direct clearing proposed however some native vegetation will be displaced as the water-level drops. There are no areas of terrestrial vegetation that are expected to be directly impacted by the proposal. Fringing wetland vegetation will be displaced as the average alignment of the bank retracts over time. This wetland vegetation comprises two EVCs (Section 3.1) which are capable of recolonising areas of suitable habitat. Seed and other propagules stored in soil and sediment will undoubtedly contribute to the recruitment of common species from these EVCs. Horizontal spread of rhizomatous sedges, rushes and other herbs will also allow the dominant species to persists around the edge of the water during and following the drawdown phase. Of equal consideration is the gain in native vegetation which will be achieved within a ten-year period. This includes the recolonisation of newly exposed banks of the reservoir by terrestrial native vegetation and the regrowth of native wetland vegetation around the fringes.

An estimate of the state-level strategic importance of the native vegetation is provided (Table 5), as well as an equivalent estimate of the gains that would be achieved. The EnSym calculations are based on current and future (3 years) water-levels provided by Melbourne Water as a PDF drawing. Consideration of gains which may be achieved should be done over a minimum ten year period. The assessment uses EVC mapping undertaken for the current assessment and modelled habitat scores from DELWP's NV_2005 spatial dataset. It also calculates losses from DELWP's modelled Strategic Biodiversity Values (SBVs) and modelled habitats for threatened species listed under the FFG Act. Weighing up the losses and gains in these modelled data will contribute to addressing application requirements of the ESO and the general policy requirements of Clause 12.01. See limitations of the EnSym assessment under the method section.

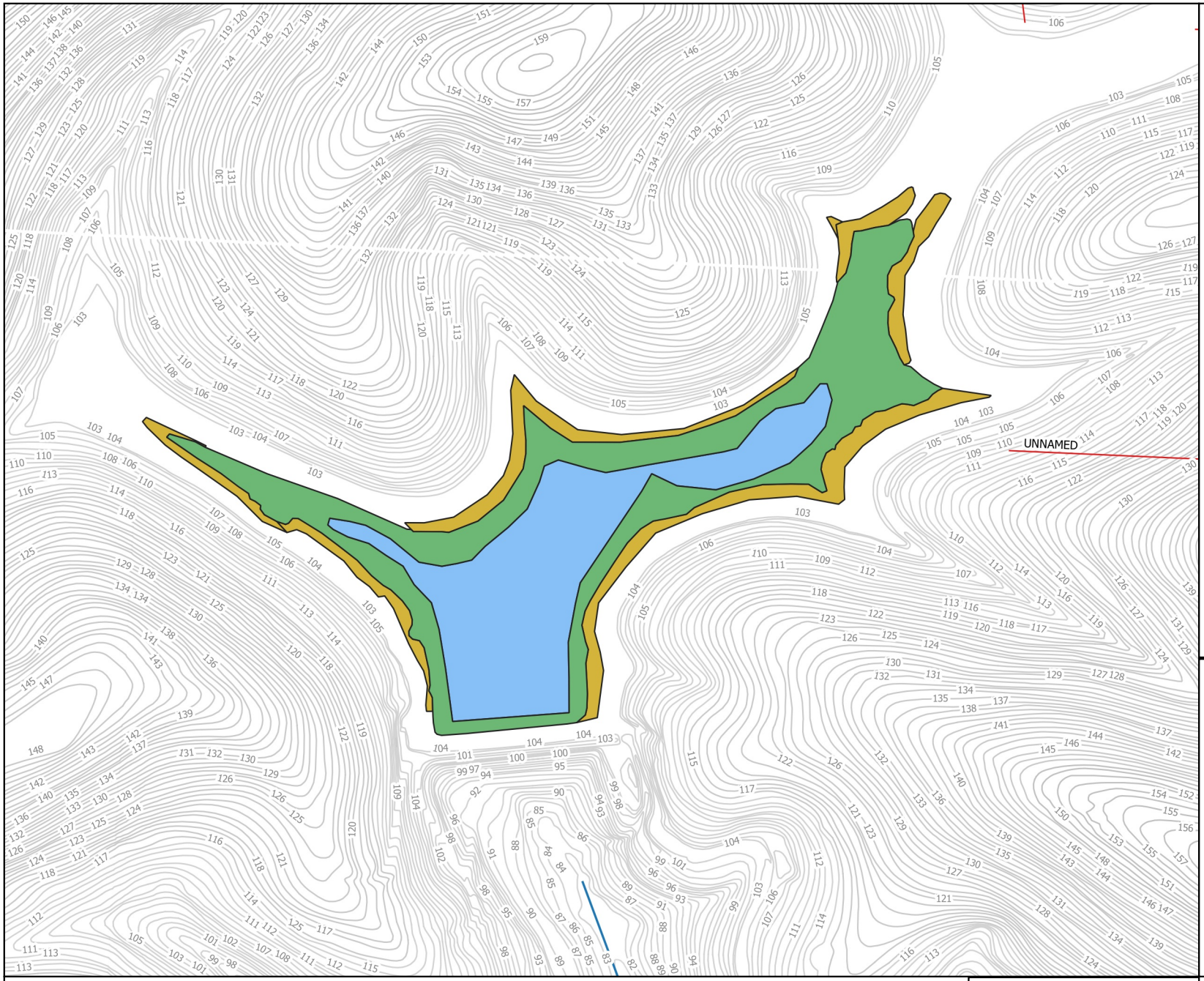
5.6.4 Summary of estimated loss and gain for the water-level drawdown

Table 4 provides a summary of losses and gains generated using EnSym and the full EnSym reports are provided in Appendix 2. We have included all Aquatic Herbland and Aquatic Sedgeland mapped on site (Figure 10) as a loss. Gains are based on the presumed recruitment of Riparian Scrub on some of the newly exposed reservoir bank fringes. Riparian Scrub was selected as a candidate EVC for the

purpose of the assessment, as the distribution of EVCs which will regenerate on newly exposed areas is not easily determined for the purposes of EnSym. No gains have been estimated for other aquatic vegetation likely to recolonise other areas within the waterbody, beyond the fringe (e.g. Aquatic Sedgeland) as estimating the likely extent of this vegetation would be speculative at best. This is important to note because currently the loss expected on site is greater than the gain, however, there is likely to be a significant amount of additional gain of aquatic vegetation. Another factor of note influencing the loss and gain scores, is that the modelled strategic biodiversity scores for reservoir waterbody are very low compared to the surrounding vegetation which is often also modelled as high. So, while the vegetation loss of the surrounding vegetation has a high modelled score, the modelled gain is low because the area is currently a waterbody. This is despite it being likely that the same vegetation type that is considered a loss, may be gained. One additional consideration is that while not all 24 modelled species habitat units will be gained (according to the report), other species modelled habitat units will be gained (for example, *Acacia stictophylla* Dandenong Wattle) and these could be used as credits, if the area were even proposed as a native vegetation offset.

Table 4. Summary of EnSym loss and gain reports

	Loss	Gain
Total extent (Patches)	1.551 ha	3.299 ha
Strategic biodiversity score	Minimum 0.416	0.325
Vicinity	Port Phillip and Westernport Catchment Management Authority (CMA) or Cardinia Shire Council.	Port Phillip and Westernport Catchment Management Authority, Cardinia Shire Council.
General habitat units	0.534	0.350
Species habitat units	1.495 *Pterostylis* sp. aff. *parviflora* (Southern Victoria) Red-tip Greenhood.	0.528 *Prototroctes maraena* Australian Grayling. 0.470 *Pultenaea weindorferi* Swamp Bush-pea. 0.470 *Caladenia oenochila* Wine-lipped Spider-orchid, 0.469 *Eucalyptus strzeleckii* Strzelecki Gum. 0.470 *Acacia stictophylla* Dandenong Wattle. 0.528 *Pterostylis* sp. aff. *parviflora* (Southern Victoria) Red-tip Greenhood.



Waterway

Area of potential gain in native vegetation*

Area of likely loss of wetland native vegetation*

Future average water level (approx.)

Geocentric Datum of Australia 1994. Base spatial data VicMap Lite (Victoria Government).Department of Environment, Land, Water & Planning. Statewide data series depicting major features, public land, vegetation, hydrology, transport and administrative data. Vicmap Lite datasets are suited for use between scales of 1: 250,000 and 1 : 5 million. The level of attribute information, the number of features and the number of vertices has been simplified to suit the 1: 250,000 - 1 : 5 million scale range. The concept of a Scale Use Code has been introduced to help control the level of detail displayed.Creative Commons Attribution 4.0 International licence, currency 18 June 2021.
Victorian Biodiversity Atlas species distribuiton data, DELWP.

0 50 100 150 200 m

Figure 12. Estimate of losses and gains in native vegetation / future average water level.

*Areas used for EnSym

Drawing MW0222-12

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5.2 Flora and Fauna Guarantee Act (FFG Act) 1988

The purpose of the *Flora and Fauna Guarantee Act 1988* (FFG Act) is to 'establish a legal and administrative structure to enable and promote the conservation of Victoria's native flora and fauna and to provide for a choice of procedures which can be used for the conservation, management or control of flora and fauna and the management of potentially threatening processes'.

At least one impact to generally protected flora will be required for the proposed drawdown (Section 46 of the FFG Act). Melbourne Water's obligation under the Act will be determined by a public authority management agreement and in relation to the proposed activity, however these are currently being drafted. Melbourne Water must consider the Act and how state threatened species may be impacted by the proposed action.

Two FFG Act species were recorded within the study area and an additional seven listed taxa have a high relative risk of being impacted by the lowering of the water-level at the reservoir.

Five of these plant taxa may occur in drier vegetation and as such, any impact is likely to be indirect, resulting from possible underlying hydrological changes to the drier vegetation within 20 m of the reservoir. It is plausible that these species may recruit into the newly into newly exposed drier bank edges, as the water is drawn down, though it is also possible that these species may be lost. Of these species, *Eucalyptus fulgens* Green Scentbark has the highest risk rating, given it was recorded at several locations within 20 m of the reservoir.

The remaining four FFG Act listed plant taxa recorded on site / with high-risk ratings, prefer wet vegetation types (e.g. Aquatic Herbland and Riparian Scrub) and (if present) are all likely to be directly impacted by the water drawdown. Of these species, Floodplain Fireweed was recorded on site, in the Aquatic Herbland (north-eastern extent). The other three species, Wiry Bossiaea, Tufted Club and *Pomaderris vacciniifolia* Round-leaf Pomaderris, (if present) are at risk of being impacted by the drawdown.

5.3 Environment Protection and Biodiversity Conservation Act (EPBC Act) 1999

The EPBC Act provides for the listing, promotion, protection and management of matters of national environmental significance. This includes nationally listed species and communities.

See Section 4.6.2 for further information about potential impacts to this species.

There were no listed species or ecological communities recorded during the current assessment. It is very unlikely that the proposed drawdown would have a significant impact on related matters of national environmental significance document elsewhere in the local area. The possibility of Round-leaf Pomaderris being present within the broader reserve does not imply that any associated impacts would be significant. None of the EPBC Act listed flora species determined to be potentially present by Biosis Research Pty Ltd (2002) were observed during the current assessment.

6 MITIGATION MEASURES

Lowering the water-level should occur over a minimum of three years. This will facilitate the migration of littoral vegetation into suitable habitat downslope, as more elevated areas dry out and become less suitable for occupancy. The transition of littoral vegetation to terrestrial treed vegetation is expected to take significantly longer and may follow a stage of shrubland (scrub) growth on newly exposed banks of the drawdown zone. Options to mitigate impacts to biodiversity include:

- Prevent access by the public, vehicles and machinery to the drawdown zone, unless for emergency. This is the area between the current high-water mark and the proposed new water level.
- Kill all woody weeds within 50 metres of the bank, prior to commencing drawdown. Maintain negligible cover in this area and the drawdown zone.
- Monitor and control high threat herbaceous weeds in the drawdown zone.
- Reduce deer abundance to the extent that visible impacts are negligible in the drawdown zone.
- Assess the status of threatened plant populations at three-year intervals.
- Assess fauna habitat values in the littoral zone at year 4. To promote native fauna and their role in plant dispersal and regeneration, introduce habitat such as woody debris, perches or nest boxes if considered necessary.
- Undertake a strategic assessment of native vegetation losses and gains ten years following commencing of drawdown. In the event of a net loss in wetland vegetation, balance this loss with further improvements to biodiversity values in the BNCR.
- Following planning requirements are ensure that specific activities fall within permitted, not permitted or exempt actions prior to selecting the appropriate course of action.

7 MANAGEMENT, MONITORING AND EVALUATION

There is no reference standard for the proposed approach for achieving the drawdown. Consideration must be made for the ecological requirements of the many species and communities present on site. The 3–5 year timeframe provides a precautionary approach and allows Melbourne Water to monitor the process and its effects on biodiversity. To ensure impacts to biodiversity are managed, a Monitoring, Evaluation, Reporting and Improvement Plan (MERI; or similar) should be developed.

Management, monitoring and evaluation should focus on (though not limited to):

- Establishing targets to be achieved including an estimate of the trajectory of various ecological values observed within the study area.
- Milestones to be achieved over a three year and ten year timeframe.
- Recruitment of threatened species and aquatic EVCs to newly exposed banks which may also include (for example) targeted searches for threatened species, and seed collection and dispersal.
- Rehabilitation of newly exposed terrestrial vegetation.
- Tree condition including habitat values for fauna.
- Deer management including both limiting access to the site (e.g. if required repair the perimeter fence) and the on-site control of numbers.
- The control of all woody weeds and high threat herbaceous weeds including **Nassella trichotoma* Serrated Tussock and **Watsonia meriana* var. *bulbillifera* Bulbil Watsonia.
- The future recreational use of the land and how this will be managed to compliment the management of ecological values and threats.

The MERI should also include information about future management of the site prior to any ancillary works (e.g. walking track installation or any works beyond the reservoir wall, that extend into areas of mapped native vegetation; Figure 10). This should include:

- Establish no-go-zones to protect known locations of Green Scentbark and Floodplain Fireweed (see Figure 10).
- Undertake spring targeted surveys for threatened species in Table 3 if any of these works are to occur outside the 20 m area searched for this report.

Incorporate the management of objectives of the project to contribute to targets set out under the Healthy Waterway Strategy.

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Appendix 1 Flora species recorded during the survey

This table is a defined area list for the reservoir bank and approximate 20 buffer.

Origin: I = Introduced to Victoria, N = Native to Victoria but not considered native to the study area. Weed risk rating (White et al. 2018): VH = very high, MH = moderately high, H = High, M = Medium

Scientific Name	Common Name	FFG status	Origin	Weed Risk Rating	Aquatic Herbland	Aquatic Sedgeland	Riparian Scrub & Swampy Riparian Woodland	Forest EVCs & other vegetation
Acacia dealbata subsp. *dealbata*	Silver Wattle						✔	✔
Acacia decurrens	Early Black-wattle		I	H				✔
Acacia elata	Cedar Wattle		I	H				✔
Acacia longifolia subsp. *longifolia*	Sallow Wattle		N	VH				
Acacia mearnsii	Black Wattle							✔
Acacia melanoxylon	Blackwood						✔	✔
Acacia mucronata subsp. *longifolia*	Narrow-leaf Wattle							✔
Acacia myrtifolia	Myrtle Wattle							✔
Acacia paradoxa	Hedge Wattle							✔
Acacia pycnantha	Golden Wattle							✔
Acacia stricta	Hop Wattle							✔
Acacia verticillata subsp. *verticillata*	Prickly Moses							✔
Acaena novae-zelandiae	Bidgee-widgee							✔
Acianthus caudatus	Mayfly Orchid							✔
Acrotriche prostrata	Trailing Ground-berry							✔
Acrotriche serrulata	Honey-pots							✔

Scientific Name	Common Name	FFG status	Origin	Weed Risk Rating	Aquatic Herbland	Aquatic Sedgeland	Riparian Scrub & Swampy Riparian Woodland	Forest EVCs & other vegetation
Adiantum aethiopicum	Common Maidenhair						✔	✔
Aira elegantissima	Delicate Hair-grass		I	MH				✔
Allocasuarina littoralis	Black Sheoak							✔
Alternanthera denticulata s.s.	Lesser Joyweed				✔			
Amyema pendula	Drooping Mistletoe							✔
Anthoxanthum odoratum	Sweet Vernal-grass		I	H				✔
Asperula conferta	Common Woodruff							✔
Austrostipa pubinodis	Tall Spear-grass							✔
Austrostipa rudis subsp. *rudis*	Veined Spear-grass							✔
Austrostipa spp.	Spear Grass							✔
Banksia marginata	Silver Banksia							✔
Billardiera mutabilis	Common Apple-berry							✔
Blechnum minus	Soft Water-fern						✔	
Blechnum nudum	Fishbone Water-fern						✔	
Blechnum parrisiae	Common Rasp-fern							✔
Boronia muelleri	Forest Boronia							✔
Bossiaea prostrata	Creeping Bossiaea							✔
Brachythecium albicans	Whitish Feather-moss		I	M				✔
Briza minor	Lesser Quaking-grass		I	MH				✔
Burchardia umbellata	Milkmaids							✔
Bursaria spinosa	Sweet Bursaria							✔

Scientific Name	Common Name	FFG status	Origin	Weed Risk Rating	Aquatic Herbland	Aquatic Sedgeland	Riparian Scrub & Swampy Riparian Woodland	Forest EVCs & other vegetation
Caesia parviflora	Pale Grass-lily							✔
Caladenia carnea s.s.	Pink Fingers							✔
Caladenia praecox	Early Hood-orchid							✔
Caladenia transitoria	Eastern Bronzehood Orchid							✔
Callitriche stagnalis	Common Water-starwort		I	MH	✔		✔	
Calochilus robertsonii s.s.	Western Beard-orchid							✔
Calochlaena dubia	Common Ground-fern						✔	✔
Campylopus clavatus	Broody Swan-neck Moss						✔	✔
Campylopus introflexus subsp. *introflexus*	Heath Star Moss						✔	✔
Carex appressa	Tall Sedge				✔	✔	✔	
Cassinia aculeata subsp. *aculeata*	Common Cassinia						✔	✔
Cassinia longifolia	Shiny Cassinia							✔
Cassinia sifton	Drooping Cassinia			M				✔
Cassytha glabella	Slender Dodder-laurel							✔
Cenchrus clandestinus	Kikuyu		I	VH			✔	✔
Centaurium erythraea	Common Centaury		I	MH				✔
Centella cordifolia	Centella				✔		✔	
Ceratodon purpureus subsp. *convolutus*	Redshank Moss							✔
Chamaescilla corymbosa var. *corymbosa*	Blue Stars							✔
Chiloglottis valida	Common Bird-orchid							
Chiloscyphus semiteres var. *semiteres*	Common Crestwort						✔	✔

Scientific Name	Common Name	FFG status	Origin	Weed Risk Rating	Aquatic Herbland	Aquatic Sedgeland	Riparian Scrub & Swampy Riparian Woodland	Forest EVCs & other vegetation
Cirsium vulgare	Spear Thistle		I	MH			✔	✔
Comesperma volubile	Love Creeper							✔
Coprosma quadrifida	Prickly Currant-bush						✔	✔
Coronidium scorpioides s.s.	Button Everlasting							✔
Correa reflexa	Common Correa							✔
Crassula helmsii	Swamp Crassula				✔			
Cryptostylis subulata	Large Tongue-orchid							✔
Cyathea australis	Rough Tree-fern						✔	
Cycnogeton procerum s.s.	Common Water-ribbons				✔		✔	
Cyperus eragrostis	Drain Flat-sedge		I	M	✔		✔	
Deyeuxia quadriseta	Reed Bent-grass							✔
Dianella admixta	Black-anther Flax-lily							✔
Dianella tasmanica	Tasman Flax-lily							✔
Dichelachne rara	Common Plume-grass							✔
Dichondra repens	Kidney-weed						✔	✔
Dicranoloma billarderi	Common Fork-moss							✔
Dillwynia cinerascens s.s.	Grey Parrot-pea							✔
Dillwynia glaberrima	Smooth Parrot-pea							✔
Drosera aberrans	Scented Sundew							✔
Drosera auriculata	Tall Sundew							✔
Ehrharta erecta	Panic Veldt-grass		I	VH			✔	✔

Scientific Name	Common Name	FFG status	Origin	Weed Risk Rating	Aquatic Herbland	Aquatic Sedgeland	Riparian Scrub & Swampy Riparian Woodland	Forest EVCs & other vegetation
Eleocharis acuta	Common Spike-sedge				✔		✔	
Eleocharis sphacelata	Tall Spike-sedge					✔		
Epacris impressa	Common Heath							✔
Erica lusitanica	Spanish Heath		I	VH				✔
Erigeron sumatrensis	Tall Fleabane		I	MH				✔
Eucalyptus cephalocarpa s.s.	Mealy Stringybark							✔
Eucalyptus cypellocarpa	Mountain Grey-gum						✔	✔
Eucalyptus dives	Broad-leaf Peppermint							✔
Eucalyptus fulgens	Green Scentbark	Endangered						✔
Eucalyptus goniocalyx subsp. *goniocalyx*	Bundy							✔
Eucalyptus obliqua	Messmate Stringybark							✔
Eucalyptus ovata	Swamp Gum						✔	✔
Eucalyptus radiata subsp. radiata	Narrow-leaf Peppermint							✔
Eucalyptus viminalis subsp. *viminalis*	Manna Gum							✔
Euchiton japonicus s.s.	Creeping Cudweed						✔	
Eurhynchium praelongum	Common Feather-moss		I	H	✔		✔	
Exocarpos cupressiformis	Cherry Ballart							✔
Frullania falciloba	Rufous Scalewort						✔	
Gahnia radula	Thatch Saw-sedge							✔
Gahnia sieberiana	Red-fruit Saw-sedge							✔
Gamochaeta purpurea s.s.	Spiked Cudweed		I	MH			✔	

Scientific Name	Common Name	FFG status	Origin	Weed Risk Rating	Aquatic Herbland	Aquatic Sedgeland	Riparian Scrub & Swampy Riparian Woodland	Forest EVCs & other vegetation
Gemmabryum sp.	Thread Moss						✔	
Genista linifolia	Flax-leaf Broom		I	VH				✔
Glossodia major	Wax-lip Orchid							✔
Gonocarpus tetragynus	Common Raspwort							✔
Goodenia lanata	Trailing Goodenia						✔	✔
Goodenia ovata	Hop Goodenia						✔	✔
Gratiola peruviana	Austral Brooklime				✔		✔	
Hakea decurrens	Bushy Needlewood							✔
Hakea ulicina	Furze Hakea							✔
Hibbertia riparia	Erect Guinea-flower						✔	
Holcus lanatus	Yorkshire Fog		I	H				✔
Hovea heterophylla	Common Hovea							✔
Hydrocotyle hirta	Hairy Pennywort						✔	
Hydrocotyle pterocarpa	Wing Pennywort				✔		✔	
Hypnum cupressiforme	Common Plait-moss						✔	
Hypochaeris glabra	Smooth Cat's-ear		I	MH				✔
Hypochaeris radicata	Flatweed		I	MH			✔	✔
Hypolepis muelleri	Harsh Ground-fern						✔	
Hypolepis sp.	Ground Fern						✔	
Isolepis inundata	Swamp Club-sedge				✔		✔	
Juncus amabilis	Hollow Rush				✔		✔	

Scientific Name	Common Name	FFG status	Origin	Weed Risk Rating	Aquatic Herbland	Aquatic Sedgeland	Riparian Scrub & Swampy Riparian Woodland	Forest EVCs & other vegetation
Juncus articulatus subsp. *articulatus*	Jointed Rush		I	H	✔		✔	
Juncus gregiflorus	Green Rush				✔		✔	
Juncus holoschoenus	Joint-leaf Rush				✔			
Juncus pallidus	Pale Rush						✔	
Juncus pauciflorus	Loose-flower Rush						✔	
Juncus planifolius	Broad-leaf Rush				✔			
Juncus procerus	Tall Rush						✔	
Juncus subsecundus	Finger Rush				✔		✔	
Kunzea leptospermoides	Yarra Burgan							✔
Lactuca serriola f. *serriola*	Prickly Lettuce		I	L				✔
Lagenophora stipitata s.s.	Blue Bottle-daisy							✔
Lagenophora sublyrata	Slender Bottle-daisy							✔
Lepidosperma laterale var. *laterale*	Variable Sword-sedge							✔
Lepidosperma laterale var. *majus*	Variable Sword-sedge						✔	✔
Lepidosperma semiteres	Wire Rapier-sedge							✔
Leptospermum continentale	Prickly Tea-tree						✔	✔
Leptospermum lanigerum	Woolly Tea-tree						✔	
Leptospermum scoparium	Manuka						✔	✔
Lilaeopsis polyantha	Australian Lilaeopsis				✔		✔	
Limosella australis	Austral Mudwort				✔		✔	
Lindsaea linearis	Screw Fern							✔

Scientific Name	Common Name	FFG status	Origin	Weed Risk Rating	Aquatic Herbland	Aquatic Sedgeland	Riparian Scrub & Swampy Riparian Woodland	Forest EVCs & other vegetation
Lobelia anceps	Angled Lobelia						✔	
Lomandra filiformis subsp. *coriacea*	Wattle Mat-rush							✔
Lomandra filiformis subsp. *filiformis*	Wattle Mat-rush							✔
Lomandra longifolia subsp. *exilis*	Cluster-headed Mat-rush							✔
Lomandra longifolia subsp. *longifolia*	Spiny-headed Mat-rush						✔	✔
Lomandra multiflora subsp. *multiflora*	Many-flowered Mat-rush							✔
Lomatia ilicifolia	Holly Lomatia							✔
Lotus subbiflorus	Hairy Bird's-foot Trefoil		I	H				✔
Lysimachia arvensis	Pimpernel		I	MH			✔	
Lythrum hyssopifolia	Small Loosestrife		I	L	✔		✔	
Melaleuca ericifolia	Swamp Paperbark						✔	
Melaleuca squarrosa	Scented Paperbark						✔	
Microlaena stipoides var. *stipoides*	Weeping Grass				✔		✔	✔
Microtis unifolia	Common Onion-orchid							✔
Myriophyllum crispatum	Upright Water-milfoil				✔			
Nassella trichotoma	Serrated Tussock		I	VH				
Olearia lirata	Snowy Daisy-bush						✔	✔
Olearia myrsinoides	Silky Daisy-bush							✔
Olearia phlogopappa subsp. *continentalis*	Dusty Daisy-bush							✔
Opercularia varia	Variable Stinkweed				✔			✔
Ornduffia reniformis	Running Marsh-flower							✔

Scientific Name	Common Name	FFG status	Origin	Weed Risk Rating	Aquatic Herbland	Aquatic Sedgeland	Riparian Scrub & Swampy Riparian Woodland	Forest EVCs & other vegetation
Oxalis corniculata s.l.	Yellow Wood-sorrel							✔
Oxalis exilis	Shade Wood-sorrel							✔
Ozothamnus ferrugineus	Tree Everlasting						✔	✔
Persicaria decipiens	Slender Knotweed				✔		✔	
Pimelea humilis	Common Rice-flower							✔
Pimelea linifolia	Slender Rice-flower							✔
Pinus radiata	Radiata Pine		I	VH				✔
Pittosporum undulatum	Sweet Pittosporum		N	VH				✔
Plantago lanceolata	Ribwort		I	M			✔	✔
Platylobium obtusangulum	Common Flat-pea							✔
Poa annua s.s.	Annual Meadow-grass		I	M				✔
Poa ensiformis	Sword Tussock-grass						✔	
Poa labillardierei	Common Tussock-grass							✔
Poa sieberiana var. *hirtella*	Grey Tussock-grass							✔
Poa tenera	Slender Tussock-grass							✔
Polytrichum juniperinum	Juniper Haircap						✔	✔
Pomaderris aspera	Hazel Pomaderris						✔	✔
Poranthera microphylla s.s.	Small Poranthera							✔
Prostanthera lasianthos	Victorian Christmas-bush						✔	
Prunella vulgaris	Self-heal		I	M	✔		✔	
Pseudoscleropodium purum	Neat Feather-moss		I	H			✔	✔

Scientific Name	Common Name	FFG status	Origin	Weed Risk Rating	Aquatic Herbland	Aquatic Sedgeland	Riparian Scrub & Swampy Riparian Woodland	Forest EVCs & other vegetation
Pteridium esculentum subsp. *esculentum*	Austral Bracken							✔
Pterostylis melagramma	Tall Greenhood							✔
Pterostylis nutans	Nodding Greenhood							✔
Pultenaea gunnii	Golden Bush-pea							✔
Pultenaea hispidula	Rusty Bush-pea							✔
Ranunculus amphitrichus	Small River Buttercup				✔		✔	
Rosa rubiginosa	Sweet Briar		I	H				✔
Rubus anglocandicans	Common Blackberry		I	H			✔	✔
Rubus polyanthemus	Forest Blackberry		I	H				✔
Rytidosperma pallidum	Silvertop Wallaby-grass							✔
Rytidosperma racemosum var. *racemosum*	Slender Wallaby-grass							✔
Rytidosperma setaceum	Bristly Wallaby-grass							✔
Rytidosperma tenuius	Purplish Wallaby-grass							✔
Schoenus apogon	Common Bog-sedge				✔		✔	
Sclerodontium pallidum	Knitting Nancy						✔	
Sematophyllum homomallum	Bronze Signal-moss						✔	
Senecio campylocarpus	Floodplain Fireweed	Endangered			✔			
Senecio glomeratus	Annual Fireweed						✔	
Senecio hispidulus s.s.	Rough Fireweed							✔
Senecio jacobaea	Ragwort		I	MH	✔		✔	✔
Senecio minimus	Shrubby Fireweed						✔	✔

Scientific Name	Common Name	FFG status	Origin	Weed Risk Rating	Aquatic Herbland	Aquatic Sedgeland	Riparian Scrub & Swampy Riparian Woodland	Forest EVCs & other vegetation
Senecio phelleus	Stony Fireweed							✔
Senecio quadridentatus	Cotton Fireweed							✔
Silene spp.	Catchfly		I	M				✔
Sonchus oleraceus	Common Sow-thistle		I	MH				✔
Sphaerolobium vimineum s.s.	Leafless Globe-pea							✔
Spyridium parvifolium	Dusty Miller							✔
Stackhousia monogyna s.s.	Creamy Candles							✔
Stellaria media	Chickweed		I	MH			✔	✔
Stylidium armeria	Common Triggerplant							✔
Taraxacum officinale spp. agg.	Garden Dandelion		I				✔	✔
Tetrarrhena juncea	Forest Wire-grass							✔
Tetratheca ciliata	Pink-bells							✔
Thelymitra juncifolia	Rush-leaf Sun-orchid							✔
Thelymitra peniculata	Trim Sun-orchid							✔
Themeda triandra	Kangaroo Grass							✔
Thuidiopsis furfurosa	Golden Weft-moss						✔	✔
Thuidiopsis sparsa	Weft Moss							✔
Thysanotus patersonii	Twining Fringe-lily							✔
Todea barbara	Austral King-fern						✔	
Tortula muralis	Common Wall-moss						✔	
Trifolium dubium	Suckling Clover		I	MH				✔

Scientific Name	Common Name	FFG status	Origin	Weed Risk Rating	Aquatic Herbland	Aquatic Sedgeland	Riparian Scrub & Swampy Riparian Woodland	Forest EVCs & other vegetation
Triglochin striata	Streaked Arrowgrass				✔			
Triquetrella papillata	Common Twine-moss						✔	
Ulex europaeus	Gorse		I	H				✔
Veronica calycina	Hairy Speedwell						✔	
Viola cleistogamoides	Hidden Violet							✔
Viola hederacea sensu Thiele & Prober	Ivy-leaf Violet							✔
Vulpia muralis	Wall Fescue		I	H				✔
Wahlenbergia gracilenta s.s.	Hairy Annual-bluebell							✔
Wahlenbergia gracilis	Sprawling Bluebell							✔
Watsonia meriana var. *bulbillifera*	Bulbil Watsonia		I	VH			✔	
Xanthorrhoea minor subsp. *lutea*	Small Grass-tree							✔
Xanthosia dissecta s.s.	Native Parsley							✔

Appendix 2. EnSym Loss and Gain reports

Scenario test – native vegetation removal

This report provides offset requirements for internal testing of different proposals to remove native vegetation. **This report DOES NOT support an application to remove, destroy or lop native vegetation under Clause 52.16 or 52.17 of planning schemes in Victoria.** A report must be obtained from the Department of Environment, Land, Water and Planning (DELWP).

Date of issue: **16/02/2022**
Time of issue: **1:37 pm**

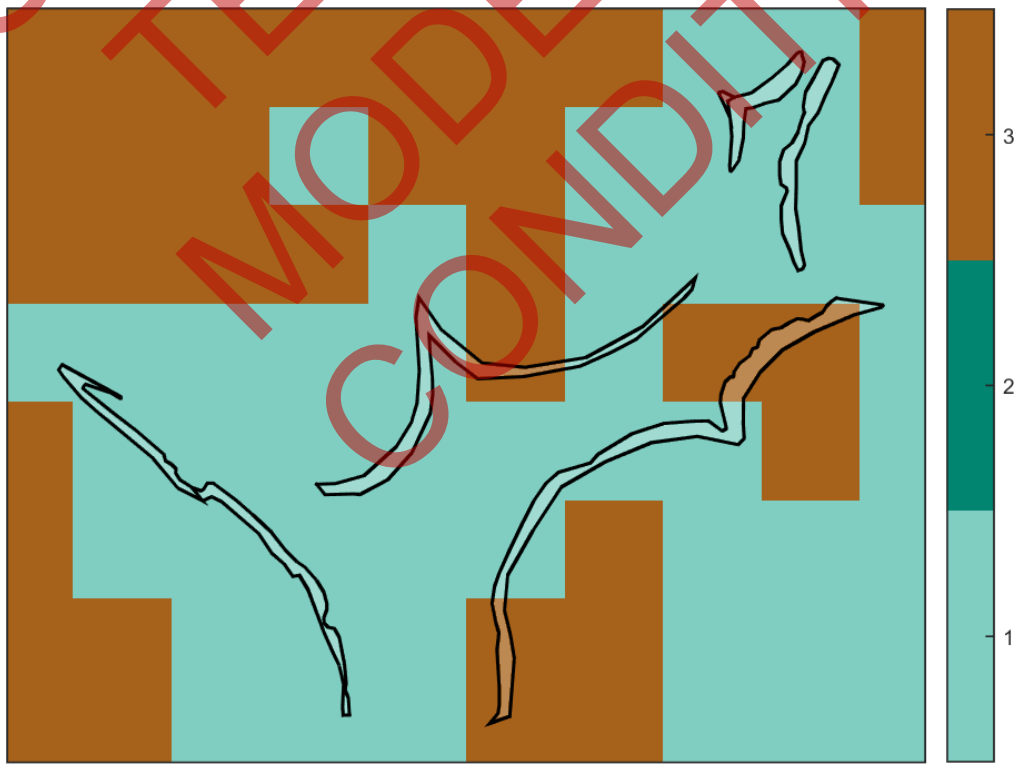
Report ID: Scenario Testing

Project ID	BeaconsfieldRes_RemV

Assessment pathway

Assessment pathway	**Detailed Assessment Pathway**
Extent including past and proposed	1.551 ha
Extent of past removal	0.000 ha
Extent of proposed removal	1.551 ha
No. Large trees proposed to be removed	0
Location category of proposed removal	Location 3 The native vegetation is in an area where the removal of less than 0.5 hectares could have a significant impact on habitat for one or more rare or threatened species.

1. Location map



Scenario test – native vegetation removal

Offset requirements if a permit is granted

Any approval granted will include a condition to obtain an offset that meets the following requirements:

General offset amount[1]	0.534 general habitat units
Vicinity	Port Phillip and Westernport Catchment Management Authority (CMA) or Cardinia Shire Council
Minimum strategic biodiversity value score[2]	0.416
Large trees*	0 large trees
Species offset amount[3]	1.495 species units of habitat for Red-tip Greenhood, *Pterostylis sp. aff. parviflora (Southern Victoria)*
Large trees*	0 trees
*** The total number of large trees that the offset must protect**	0 large trees to be protected in either the general, species or combination across all habitat units protected

NB: values within tables in this document may not add to the totals shown above due to rounding

Appendix 1 includes information about the native vegetation to be removed

Appendix 2 includes information about the rare or threatened species mapped at the site.

Appendix 3 includes maps showing native vegetation to be removed and extracts of relevant species habitat importance maps

1 The general offset amount required is the sum of all general habitat units in Appendix 1.

2 Minimum strategic biodiversity score is 80 per cent of the weighted average score across habitat zones where a general offset is required

3 The species offset amount(s) required is the sum of all species habitat units in Appendix 1.

Scenario test – native vegetation removal

Next steps

Any proposal to remove native vegetation must meet the application requirements of the Detailed Assessment Pathway and it will be assessed under the Detailed Assessment Pathway.

This report DOES NOT support an application to remove, destroy or lop native vegetation under Clause 52.16 or 52.17 of planning schemes in Victoria.

If you wish to remove the mapped native vegetation you must submit the related shapefiles to the Department of Environment, Land, Water and Planning (DELWP) for processing, by email to ensymnvrtool.support@delwp.vic.gov.au. DELWP will provide a *Native vegetation removal report* that is required to meet the permit application requirements in accordance with *Guidelines for the removal, destruction or lopping of native vegetation* (Guidelines).

Appendix 1: Description of native vegetation to be removed

The species-general offset test was applied to your proposal. This test determines if the proposed removal of native vegetation has a proportional impact on any rare or threatened species habitats above the species offset threshold. The threshold is set at 0.005 per cent of the mapped habitat value for a species. When the proportional impact is above the species offset threshold a species offset is required. This test is done for all species mapped at the site. Multiple species offsets will be required if the species offset threshold is exceeded for multiple species.

Where a zone requires species offset(s), the species habitat units for each species in that zone is calculated by the following equation in accordance with the Guidelines:

Species habitat units = extent x condition x species landscape factor x 2, where the species landscape factor = 0.5 + (habitat importance score/2)

The species offset amount(s) required is the sum of all species habitat units per zone

Where a zone does not require a species offset, the general habitat units in that zone is calculated by the following equation in accordance with the Guidelines:

General habitat units = extent x condition x general landscape factor x 1.5, where the general landscape factor = 0.5 + (strategic biodiversity value score/2)

The general offset amount required is the sum of all general habitat units per zone.

Native vegetation to be removed

Information provided by or on behalf of the applicant in a GIS file						Information calculated by EnSym						
Zone	**Type**	**BioEVC**	**BioEVC conservation status**	**Large tree(s)**	**Partial removal**	**Modelled Condition score**	**Polygon Extent**	**Extent without overlap**	**SBV score**	**HI score**	**Habitat units**	**Offset type**
3-A	Patch	hsf_0308	Endangered	0	no	0.788	0.128	0.128	0.663		0.126	General
4-A	Patch	hsf_0308	Endangered	0	no	0.788	0.182	0.182	0.345		0.145	General
5-A	Patch	hsf_0308	Endangered	0	no	0.782	0.579	0.579	0.387	1.000	0.906	505293 Red-tip Greenhood *Pterostylis sp. aff. parviflora (Southern Victoria)*
6-A	Patch	hsf_0308	Endangered	0	no	0.773	0.163	0.163	0.386		0.131	General
7-A	Patch	hsf_0308	Endangered	0	no	0.778	0.378	0.378	0.452	1.000	0.589	505293 Red-tip Greenhood *Pterostylis sp. aff. parviflora (Southern Victoria)*
1-A	Patch	hsf_0653	Endangered	0	no	0.824	0.008	0.008	0.816		0.009	General
2-A	Patch	hsf_0653	Endangered	0	no	0.807	0.113	0.113	0.814		0.124	General

Appendix 2: Information about impacts to rare or threatened species' habitats on site

This table lists all rare or threatened species' habitats mapped at the site.

Species common name	Species scientific name	Species number	Conservation status	Group	Habitat impacted	% habitat value affected
Red-tip Greenhood	*Pterostylis sp. aff. parviflora (Southern Victoria)*	505293	Rare	Highly Localised Habitat	Habitat importance map	0.0766
Wine-lipped Spider-orchid	*Caladenia oenochila*	503694	Vulnerable	Dispersed	Habitat importance map	0.0021
Dandenong Wattle	*Acacia stictophylla*	505140	Rare	Dispersed	Habitat importance map ; special site	0.0021
Australian Grayling	*Prototroctes maraena*	4686	Vulnerable	Dispersed	Habitat importance map	0.0017
Swamp Bush-pea	*Pultenaea weindorferi*	502881	Rare	Dispersed	Habitat importance map	0.0016
Strzelecki Gum	*Eucalyptus strzeleckii*	504558	Vulnerable	Dispersed	Habitat importance map	0.0013
Winter Sun-orchid	*Thelymitra hiemalis*	505006	Endangered	Dispersed	Habitat importance map	0.0007
Green Scentbark	*Eucalyptus fulgens*	505175	Rare	Dispersed	Habitat importance map	0.0005
Spurred Helmet-orchid	*Corybas aconitiflorus*	500835	Rare	Dispersed	Habitat importance map	0.0004
Rough Daisy-bush	*Olearia asterotricha*	502300	Rare	Dispersed	Habitat importance map	0.0004
Hoary Rapier-sedge	*Lepidosperma canescens*	501915	Rare	Dispersed	Habitat importance map	0.0004
Green-striped Greenhood	*Pterostylis chlorogramma*	504728	Vulnerable	Dispersed	Habitat importance map	0.0003
Blue-billed Duck	*Oxyura australis*	10216	Endangered	Dispersed	Habitat importance map	0.0003
Growling Grass Frog	*Litoria raniformis*	13207	Endangered	Dispersed	Habitat importance map	0.0002
Swamp Fireweed	*Senecio psilocarpus*	504659	Vulnerable	Dispersed	Habitat importance map	0.0002
Southern Toadlet	*Pseudophryne semimarmorata*	13125	Vulnerable	Dispersed	Habitat importance map	0.0002
Cobra Greenhood	*Pterostylis grandiflora*	502798	Rare	Dispersed	Habitat importance map ; special site	0.0002
Parsley Xanthosia	*Xanthosia leiophylla*	504562	Rare	Dispersed	Habitat importance map	0.0002
Hardhead	*Aythya australis*	10215	Vulnerable	Dispersed	Habitat importance map	0.0002

Tufted Club-sedge	*Isolepis wakefieldiana*	501789	Rare	Dispersed	Habitat importance map	0.0002
Musk Duck	*Biziura lobata*	10217	Vulnerable	Dispersed	Habitat importance map	0.0002
Baillon's Crake	*Porzana pusilla palustris*	10050	Vulnerable	Dispersed	Habitat importance map	0.0002
Brickmaker's Sedge	*Gahnia grandis*	501390	Vulnerable	Dispersed	Habitat importance map	0.0002
Swamp Skink	*Lissolepis coventryi*	12407	Vulnerable	Dispersed	Habitat importance map	0.0001
Floodplain Fireweed	*Senecio campylocarpus*	507136	Rare	Dispersed	Habitat importance map	0.0001
Lewin's Rail	*Lewinia pectoralis pectoralis*	10045	Vulnerable	Dispersed	Habitat importance map	0.0001
Grey Goshawk	*Accipiter novaehollandiae novaehollandiae*	10220	Vulnerable	Dispersed	Habitat importance map	0.0001
Intermediate Egret	*Ardea intermedia*	10186	Endangered	Dispersed	Habitat importance map	0.0001
Forest Phebalium	*Phebalium squamulosum subsp. squamulosum*	504817	Rare	Dispersed	Habitat importance map	0.0001
Masked Owl	*Tyto novaehollandiae novaehollandiae*	10250	Endangered	Dispersed	Habitat importance map	0.0001
Clover Glycine	*Glycine latrobeana*	501456	Vulnerable	Dispersed	Habitat importance map	0.0001
Tremont Bundy	*Eucalyptus aff. goniocalyx (Dandenong Ranges)*	507008	Vulnerable	Dispersed	Habitat importance map	0.0001
Powerful Owl	*Ninox strenua*	10248	Vulnerable	Dispersed	Habitat importance map	0.0000
Lace Monitor	*Varanus varius*	12283	Endangered	Dispersed	Habitat importance map	0.0000
Austral Crane's-bill	*Geranium solanderi var. solanderi s.s.*	505337	Vulnerable	Dispersed	Habitat importance map	0.0000
Spot-tailed Quoll	*Dasyurus maculatus maculatus*	11008	Endangered	Dispersed	Habitat importance map	0.0000
White-throated Needletail	*Hirundapus caudacutus*	10334	Vulnerable	Dispersed	Habitat importance map	0.0000
Velvet Apple-berry	*Billardiera scandens s.s.*	504290	Rare	Dispersed	Habitat importance map	0.0000
Southern Xanthosia	*Xanthosia tasmanica*	504088	Rare	Dispersed	Habitat importance map	0.0000
Powelltown Correa	*Correa reflexa var. lobata*	505404	Rare	Dispersed	Habitat importance map ; special site	0.0000
Large-leaf Cinnamon-wattle	*Acacia leprosa var. uninervia*	505141	Rare	Dispersed	Habitat importance map	0.0000

Sooty Owl	*Tyto tenebricosa tenebricosa*	10253	Vulnerable	Dispersed	Habitat importance map	0.0000
Greater Glider	*Petauroides volans*	11133	Vulnerable	Dispersed	Habitat importance map	0.0000
Slender Stylewort	*Levenhookia sonderi*	501998	Rare	Dispersed	Habitat importance map	0.0000
Square-tailed Kite	*Lophoictinia isura*	10230	Vulnerable	Dispersed	Habitat importance map	0.0000

Habitat group

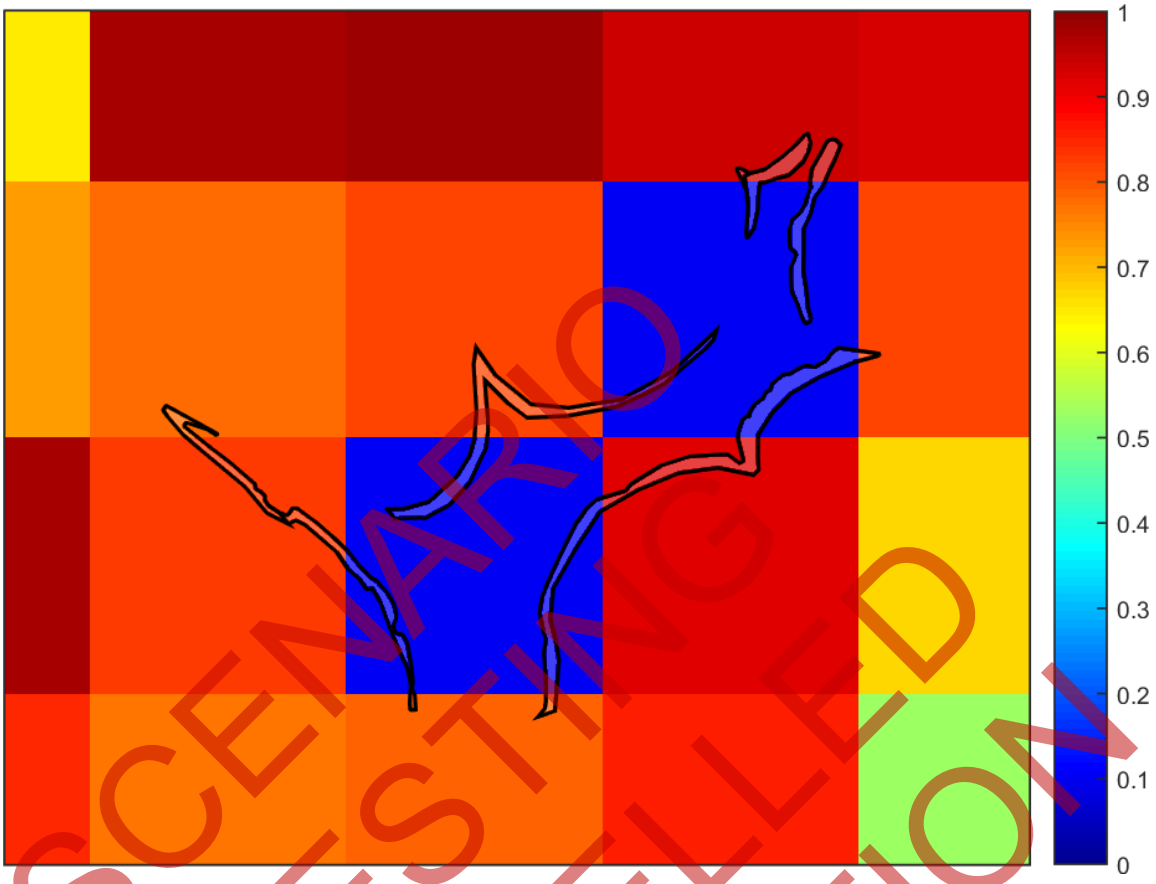
- Highly localised habitat means there is 2000 hectares or less mapped habitat for the species
- Dispersed habitat means there is more than 2000 hectares of mapped habitat for the species

Habitat impacted

- Habitat importance maps are the maps defined in the Guidelines that include all the mapped habitat for a rare or threatened species
- Top ranking maps are the maps defined in the Guidelines that depict the important areas of a dispersed species habitat, developed from the highest habitat importance scores in dispersed species habitat maps and selected VBA records
- Selected VBA record is an area in Victoria that represents a large population, roosting or breeding site etc.

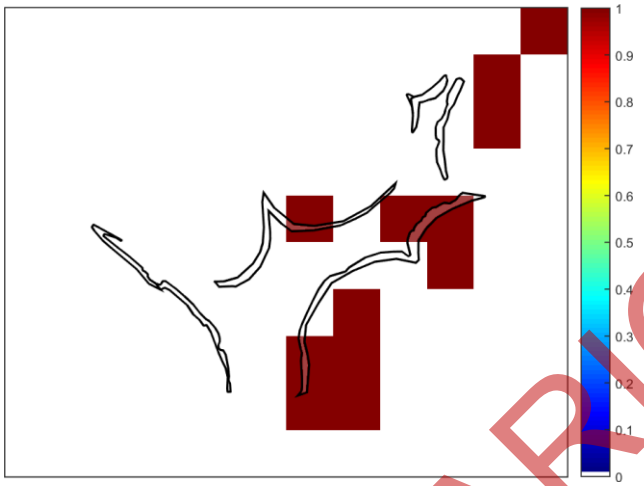
Appendix 3 – Images of mapped native vegetation

2. Strategic biodiversity values map



3. Habitat importance maps

Red-tip Greenhood
Pterostylis sp. aff. parviflora (Southern Victoria)
505293



Scenario test – native vegetation offset

This report provides information about a potential native vegetation offset site for internal testing of different proposals to protect native vegetation. **This report IS NOT a *Native vegetation offset report*.** A report must be obtained from the Department of Environment, Land, Water and Planning (DELWP).

Date of issue: **16/02/2022** **Report ID: Scenario Testing**
Time of issue: **2:02 pm**

Project ID	BeaconsfieldRes_GainV

Extent of proposed offset site

Total extent	3.299 ha
Patches	3.299 ha
Revegetation	0.000 ha
Scattered tree(s)	0.000 ha

Habitat units of gain for the proposed offset site

The offset site has the following total general and species habitat units. These units can be used to satisfy a **single permit condition** or if the offset site is established as a **first party offset site**.

Total habitat units and attributes used for a single permit (once off use)	
Number of large tree(s)	Nil large trees are protected at the offset site
General habitat units	0.350 general habitat units Port Phillip And Westernport CMA, Cardinia Shire Council 0.325 Strategic biodiversity value
Species habitat units	0.528 species habitat units for Australian Grayling, *Prototroctes maraena* 0.470 species habitat units for Swamp Bush-pea, *Pultenaea weindorferi* 0.470 species habitat units for Wine-lipped Spider-orchid, *Caladenia oenochila* 0.469 species habitat units for Strzelecki Gum, *Eucalyptus strzeleckii* 0.470 species habitat units for Dandenong Wattle, *Acacia stictophylla* 0.528 species habitat units for Red-tip Greenhood, *Pterostylis sp. aff. parviflora (Southern Victoria)*

Habitat units of gain per zone of the proposed offset site

This table provides the habitat units of gain per zone of the offset site. Trading and allocation of units within the **Native Vegetation Credit Register** takes place at the zone.

The species-general offset test is done to determine which species the proposed offset site provides habitat for. The threshold is set at 0.0025 per cent of the mapped habitat value for a species. When the threshold is met or exceeded, species habitat units are generated. If required species habitat units can be generated for all other species mapped at the site. Multiple species units will be generated if the threshold is exceeded for multiple species.

The species habitat units for each species in a zone is calculated by the following equation in accordance with the Guidelines:

Species habitat units = extent x gain score x species landscape factor, where the species landscape factor = 0.5 + (habitat importance score/2)

The general habitat units in a zone is calculated by the following equation in accordance with the Guidelines:

General habitat units = extent x gain score x general landscape factor, where the general landscape factor = 0.5 + (strategic biodiversity value score/2)

Species and general habitat units are alternates and the use or sale of one type of unit will affect the number of other types of units remaining.

Information provided by or on behalf of the applicant				**Information calculated by EnSym**					
Zone	Type	Gain score	Large tree	Polygon extent	Extent without overlap	SBV	HIS	Habitat units	Attributes
1-A	Patch	0.160	0	3.299	3.299	0.325		0.350 general habitat units	Port Phillip And Westernport ; Cardinia Shire
							1.000	0.528 species habitat units	4686 Australian Grayling, *Prototroctes maraena*
							0.779	0.470 species habitat units	502881 Swamp Bush-pea, *Pultenaea weindorferi*
							0.779	0.470 species habitat units	503694 Wine-lipped Spider-orchid, *Caladenia oenochila*
							0.778	0.469 species habitat units	504558 Strzelecki Gum, *Eucalyptus strzeleckii*
							0.779	0.470 species habitat units	505140 Dandenong Wattle, *Acacia stictophylla*
							1.000	0.528 species habitat units	505293 Red-tip Greenhood, *Pterostylis sp. aff. parviflora (Southern Victoria)*

Next steps

To protect native vegetation as an offset you must obtain a Native vegetation offset report from Department of Environment, Land, Water and Planning (DELWP). **This report IS NOT a *Native vegetation offset report*.**

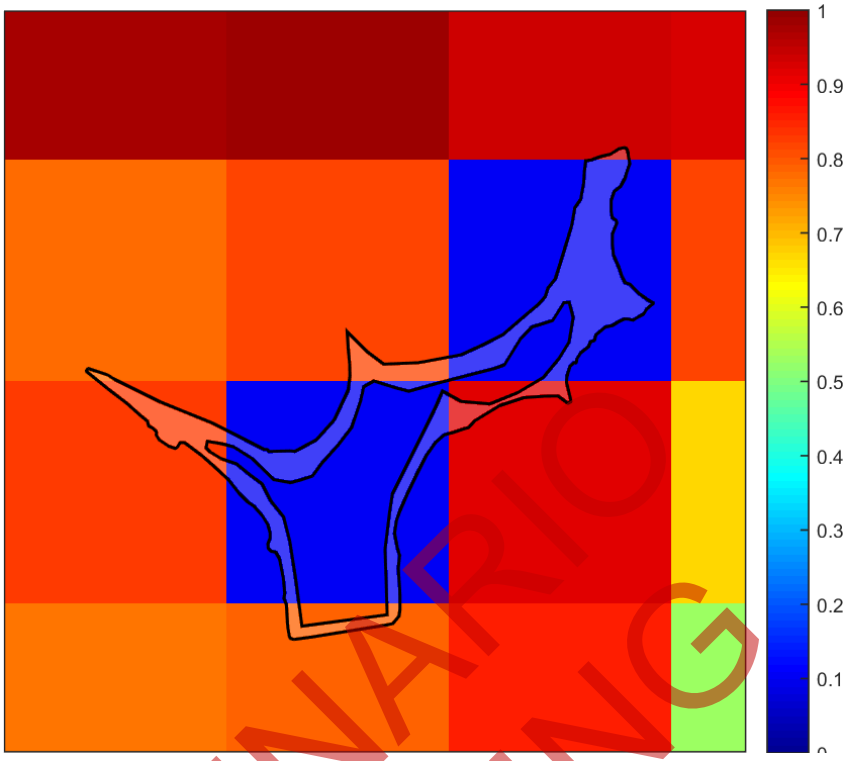
Offset sites must meet eligibility criteria as outlined in the *Guidelines for the removal, destruction or lopping of native vegetation* and the *Native vegetation gain scoring manual, version 2* available on the DELWP website, and any other relevant requirements. Eligible offset sites that are intended to be banked or sold as credits must be registered on the Native Vegetation Credit Register (NVCR). A gain scoring assessment must be done before any offset can be registered on the NVCR. All proposed offset sites must be secured by a relevant security agreement that includes an offset management plan.

Once the extent of the proposed offset area is finalised, submit your data standard compliant shapefiles by email to ensymnvrtool.support @delwp.vic.gov.au for processing.

Appendix 1 – Images of marked native vegetation

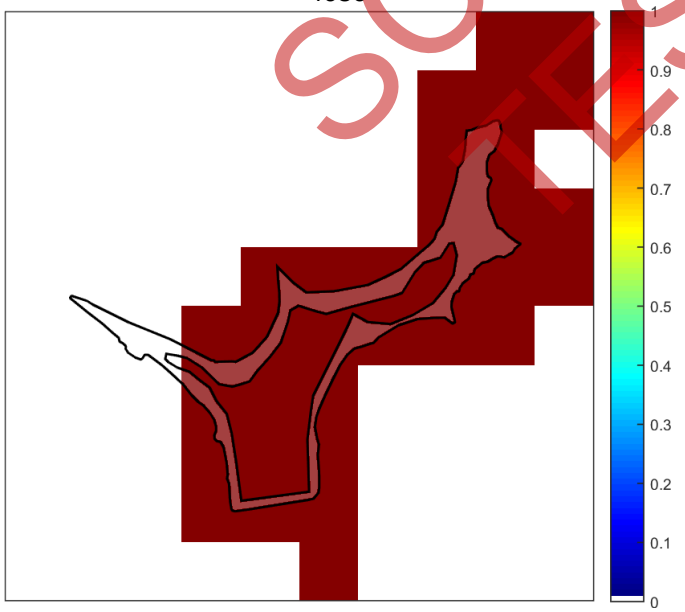
1. Aerial photograph showing marked native vegetation

2. Strategic biodiversity value map

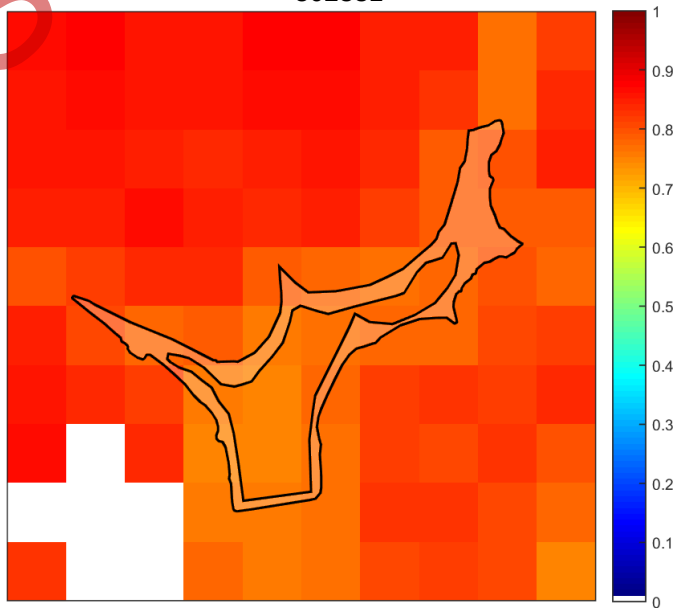


2. Habitat importance maps

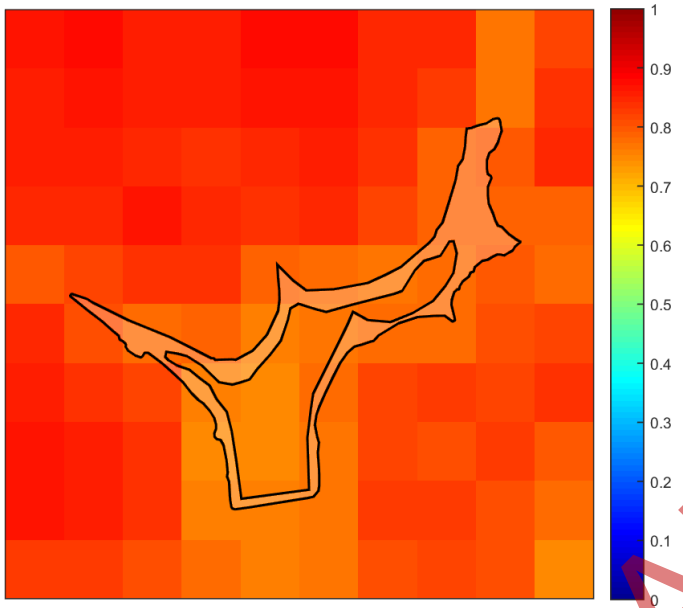
Australian Grayling
Prototroctes maraena
4686



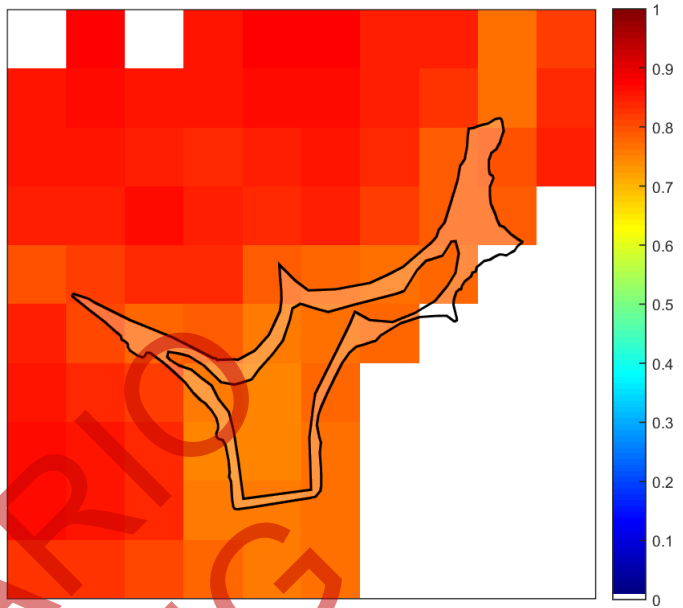
Swamp Bush-pea
Pultenaea weindorferi
502881



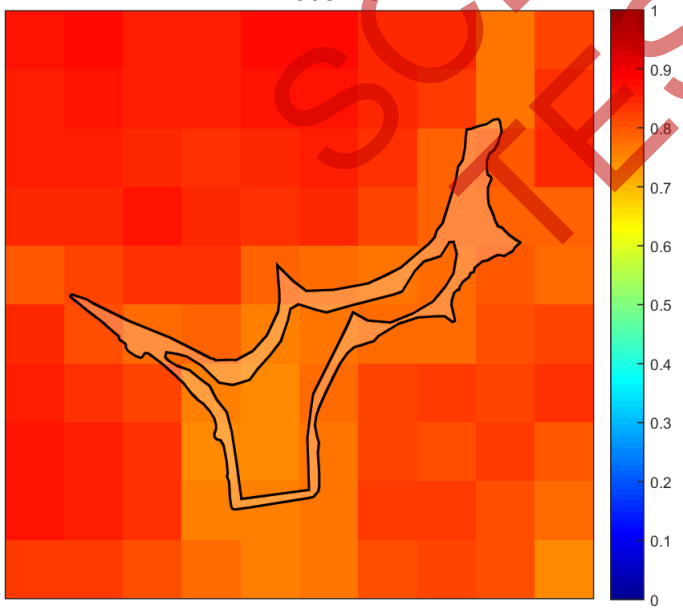
Wine-lipped Spider-orchid
Caladenia oenochila
503694



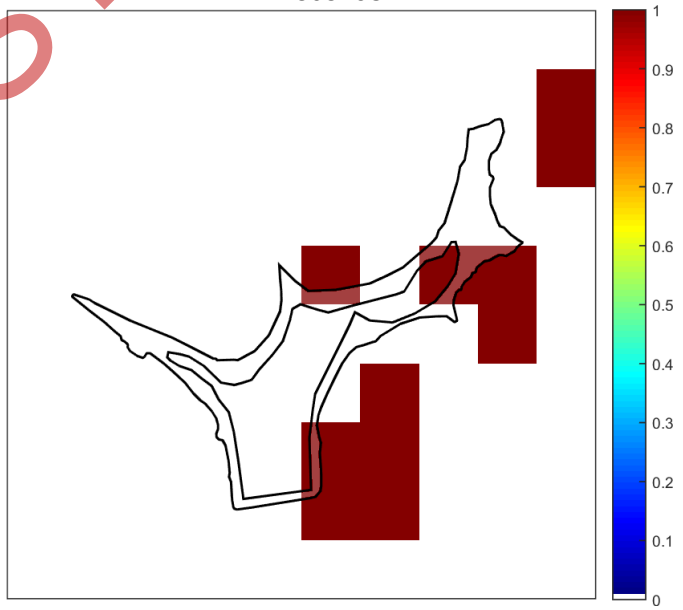
Strzelecki Gum
Eucalyptus strzeleckii
504558



Dandenong Wattle
Acacia stictophylla
505140



Red-tip Greenhood
Pterostylis sp. aff. parviflora (Southern Victoria)
505293



SCENARIO TESTING

GLOSSARY

Alternate offset types

Offset types within a zone are alternates. The use of one offset type will result in the proportional reduction of all other offset types within the zone. Refer to *Native vegetation offset sites* fact sheet available on the DELWP website for more information.

Gain score

This is the site-assessed gain score for the native vegetation based on the agreed management and security commitments. Each zone in the proposed offset site is assigned a gain score according to the gain scoring assessment. The score is divided by 100 to give a number between 0 and 1.

General habitat units of gain

The general habitat units quantify the overall contribution that the protection and management of native vegetation at the offset site makes to Victoria's biodiversity. The general habitat units are calculated as follows:

$$\textbf{General habitat units} = \textbf{extent} \times \textbf{gain score} \times \textbf{general landscape factor}$$

General landscape factor

The general landscape factor is the adjusted strategic biodiversity value (SBV) score. The SBV score is adjusted so that site-based biodiversity information has more influence on the number of units.

General offset attributes

The attributes of a general offset includes the location (Catchment Management Authority and Municipal District), strategic biodiversity value score and the number of large trees protected.

Offset type

There are two types of offsets, general offsets and species offsets. All offset sites include general offsets. Sites that are mapped as habitat for rare or threatened species can also include species offsets for the mapped species.

Species offset attributes

The attributes of a species offset is the mapped habitat for the species and the number of large trees protected.

Species habitat units of gain

The species habitat units quantify the overall contribution that the protection and management of native vegetation at an offset site makes to the habitat of the relevant rare or threatened species. Species habitat units are calculated for each species in the zone where the result of the threshold test is greater than 0.0025 per cent. Species units are calcualted as follows:

$$\textbf{Species habitat units}_{\textbf{species x}} = \textbf{extent} \times \textbf{gain score} \times \textbf{species landscape factor}_{\textbf{species x}}$$