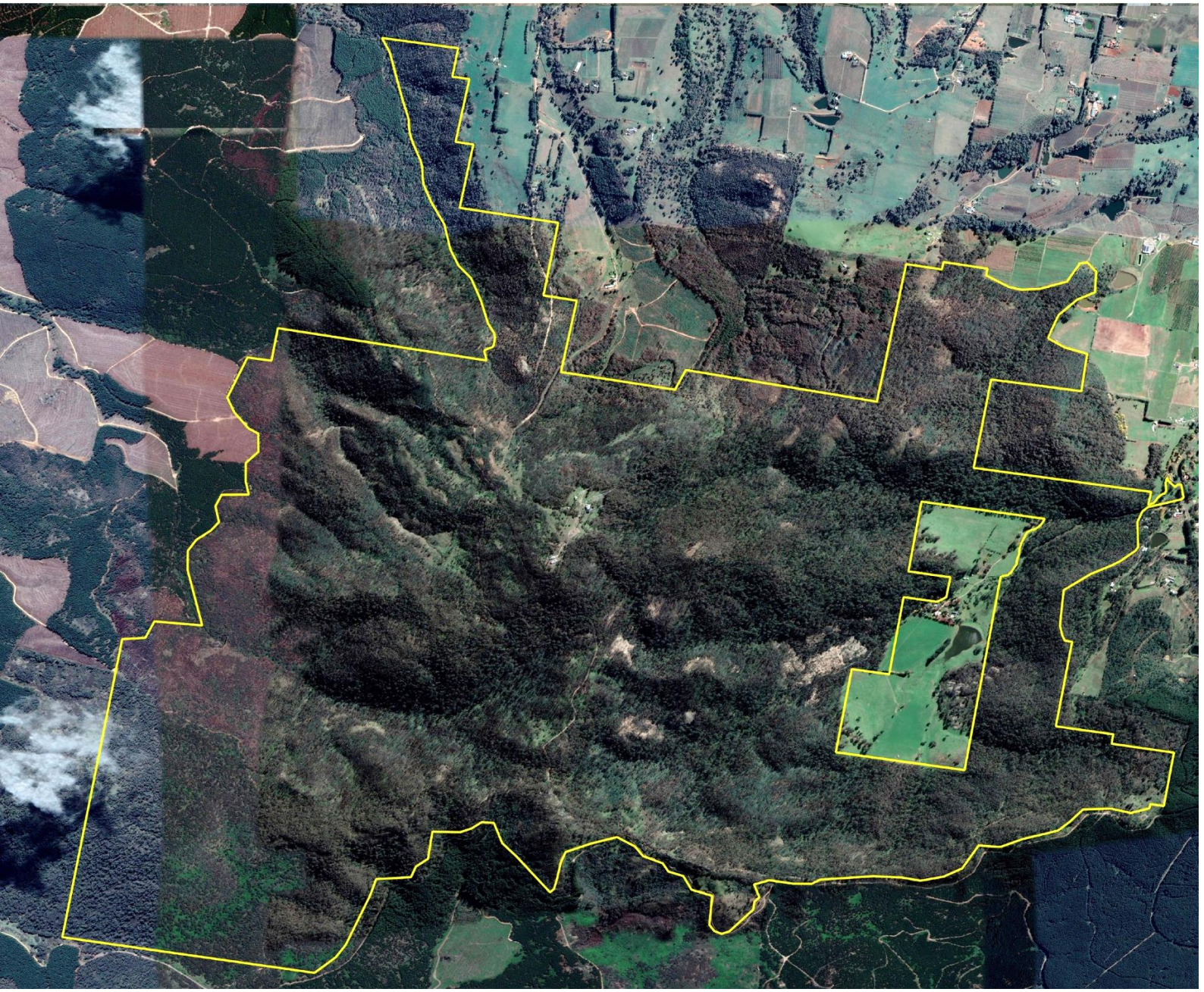
Biodiversity Values and Constraints on Development in the Mount Canobolas State Conservation Area



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EXECUTIVE SUMMARY

This document outlines the unique and threatened biodiversity values of the Mt Canobolas State Conservation Area (SCA) and presents previously unpublished data on its distribution within the SCA.

Environmental constraints on development are considered in relation to current legislation for biodiversity protection in NSW.

It is concluded that a mountain biking complex proposed by Orange City Council (OCC) for the SCA would inevitably cause significant and unacceptable environmental harm.

Overall, this report finds that it would be impossible to establish a mountain biking track network in any part of the conservation reserve without having a significant negative impact on biodiversity.

This is because the entire reserve supports biodiversity for which further losses of individuals or habitat places them at risk of extinction. No parts of the conservation area are without threatened biodiversity.

Most importantly, the entire reserve meets the criteria for gazetting as an Area of Outstanding Biodiversity Value (AOBV) and was nominated for this status more than two years ago. The nomination of the SCA for AOBV status has passed scientific scrutiny within the Biodiversity Conservation Division of the NSW Department of Planning, Industry and Environment, with public consultation the only remaining hurdle.

Further, the entire reserve supports vegetation communities that are listed under the NSW Biodiversity Conservation Act as either Endangered or Critically Endangered.

In addition, the reserve supports three communities and four species so rare that any disturbance to them is considered to be a 'Serious and Irreversible Impact.' These entities may only be disturbed if the loss of biodiversity is outweighed by the benefits to the State.

Finally, a further 13 species, that occur in the SCA and nowhere else on earth, would also qualify for consideration as having Serious and Irreversible Impact status.

There is no comparable reserve in the Central West (and likely very few reserves of similar size in NSW) that supports such an array of unique biodiversity.

It is beyond question that the Mt Canobolas SCA is the most important nature conservation reserve in the region and must be protected in perpetuity from inappropriate development of any kind, including mountain bike development, such as proposed by OCC.

In terms of potential harm to unique biodiversity there is no worse place in the region for the establishment of a mountain biking park.

FINDINGS AND CONCLUSIONS

This document has been produced in response to a proposal by Orange City Council (OCC) to develop a large-scale mountain biking competition centre within the Mount Canobolas State Conservation Area (SCA). This report presents detailed and current site-specific scientific data on the biodiversity values of the SCA and objectively assesses the biodiversity conservation values against current environmental legislation and conservation frameworks.

FINDINGS

- Any assessment of development proposals within the SCA should recognise that it meets the criteria for an Area of Outstanding Biodiversity Value. Although the AOBV status of the Mt Canobolas SCA has not yet been officially recognised, the Precautionary Principle mandates that activities in the SCA should be assessed on the basis that it has been recommended for Preliminary Determination as an AOBV.

- The Precautionary Principle is particularly important when considering development in a reserve such as the Mt Canobolas SCA that is recognised as important for conservation of unique biodiversity, particularly since it is dedicated for that purpose. The Precautionary Principle holds that where there is a risk of harm to biodiversity and alternatives are available for the activity, the activity should not go ahead.

- Avoidance of impacts on rare or threatened entities is the first step in development planning. This report provides accurate distribution data for the biodiversity and habitats that should be avoided.

- Protection of threatened biodiversity in the SCA depends not just on the avoidance of the locations of known individuals of rare or threatened species, but also on the protection of sufficient habitat to guarantee their survival into the future.

- Many populations of species on Mt Canobolas are likely to be close to their minimum thresholds for viability owing to low population sizes, which in turn is due to the small size of the SCA (1,672 ha). In essence, many populations in the SCA cannot withstand further losses of habitat from developments such as the mountain biking proposal and the inevitable debilitating disturbances that would accompany it.

- Current ecological theory includes the concept of metapopulations which recognises that within overall areas of suitable habitat, sub-populations of species wax and wane over time, flourishing in some areas before dying out, only to rise in other areas where they had been absent. This means that even though individuals of a species may not be present in a particular area at the time of a survey, that area may nonetheless be important as potential future habitat to maintain the metapopulation.

- Habitat integrity is essential to maintain populations of threatened or endemic species, such as orchids, lilies and lichens. A criss-crossing network of mountain bikes tracks through the habitat of a threatened entity, while it may avoid the locations of known individuals,

nevertheless removes and fragments habitat, and disrupts metapopulation dynamics, whilst also potentially impacting unrecorded individuals.

- The entire forest and woodland vegetation within the Mt Canobolas SCA is part of one or other of three threatened ecological communities listed as Endangered or Critically Endangered under the Biodiversity Conservation Act (BC Act). The unique outcrop heaths and shrublands of the SCA are likely to be recognised as a distinct Plant Community Type in the future that would likely qualify for listing as threatened.

- Four endemic flora species, *Prostanthera gilesii*, *Eucalyptus canobolensis*, *Caladenia boweri* and *Paraprasophyllum canobolense* have been described from the SCA. The first two are listed as Critically Endangered and Vulnerable, respectively, and the latter two have been nominated as threatened.

- Six other flora species in the genera *Bulbine, Melichrus, Dipodium, Diuris, Asterolasia and Phebalium* are also under study as putative new endemic species restricted to the Mount Canobolas Volcanic Complex. All are likely to qualify for listing as threatened.

- It can be expected that more endemic species unique to the Mt Canobolas SCA will be discovered among the more than 200 species with disjunct populations isolated on the mountain. Accordingly, the SCA is a scientific treasure house of genetic diversity which should be protected for the value of its biodiversity above all else.

- There are very few, if any, places that have as much biodiversity value in a relatively small area as Mt Canobolas SCA. It would be tragic if unrecognised species were pushed towards extinction by unsympathetic development, even before they are discovered.

- The SCA is the only refuge in the Orange district for montane and sub-alpine herbs that are now locally rare, and in some cases, endangered. The high species richness and numbers of these herbs indicate the ecosystem functions over large parts of the SCA remain in close to pristine condition. In particular, 12 areas of high native orchid diversity, or ‘orchid hotspots’, are identified in this report and should be protected.

- Four lichen species, *Gyalideopsis halocarpa*, *Sarcogyne sekikaica*, *Megalaria montana* and *Xanthoparmelia metastrigosa* are endemic to the SCA and all are likely to qualify for listing as threatened.

- The SCA hosts the only lichen community in Australia to be listed as threatened, the *Mt Canobolas Xanthoparmelia Lichen Community Endangered Ecological Community*. It is prominent on rock plates, rock outcrops and surface rock in the SCA and is threatened by mountain bike and foot traffic on rock plates and rock gardens.

- One fauna species is confirmed as endemic in the SCA, the Mt Canobolas Velvet Worm, *Cephalofovea pavimenta*. A yellow planarian worm, *Fletchamia* near *sugdeni* may represent another endemic invertebrate species. Systematic survey of invertebrates would likely considerably expand the known biodiversity of the SCA and reveal more endemic species.

- Seven described species or ecological communities in the SCA have been identified by the Biodiversity Conservation Division of the Department of Planning Industry and Environment as susceptible to Serious and Irreversible Impacts (SAII). In addition, a further 13 described and undescribed species endemic to the SCA would also meet the SAII criteria and must be assessed accordingly.

- The data and mapping in this report show clearly that significant biodiversity occurs throughout the Mt Canobolas SCA. There are no areas of the SCA without significant biodiversity. Consequently, any large-scale development within the SCA is highly likely to have adverse impacts on multiple sensitive areas and entities.

- This report identifies eight highly sensitive areas of exceptional conservation significance within the SCA where any development should be prohibited.

- It is important to note that not all parts of the SCA have been adequately surveyed and that it is likely other important populations, hotspots and individual occurrences of important biodiversity remain to be discovered.

CONCLUSIONS and RECOMMENDATIONS

- It is recommended that minimum buffers of 50 m be set for individual plants, populations, habitat areas, threatened ecological communities and orchid hotspots to avoid damage to threatened biodiversity in the SCA.

- The unusually high biodiversity value of the Mt Canobolas SCA is demonstrated by four outstanding characteristics:
    1. The SCA meets the criteria as an Area of Outstanding Biodiversity Value (AOBV).
    2. It has an unusually high number of endemic species (11+) for such a small reserve (1,672 ha), two of which are listed as threatened so far.
    3. It has a unique threatened endemic lichen community.
    4. It has a large number of communities and species (20) meeting the criteria for Serious and Irreversible Impacts (SAII).

- It is incumbent on the proponent's consultants to assess the impacts of proposed developments in the SCA as if it were an AOBV. This means that under the BC Act the development cannot be assessed by a Review of Environmental Factors, but must be assessed under the Biodiversity Offsets Scheme using the Biodiversity Assessment Method (BAM) and a Biodiversity Development Assessment Report (BDAR).

- The survival of eleven species endemic to the Mount Canobolas Volcanic Complex depends on the protection of their habitats from development. All of these taxa have very low areas of occupancy and most have very low population sizes. Consequently, any loss of habitat pushes them towards extinction.

- Because of the rarity and confinement of the endemic species within the SCA, it is not possible to offset losses to their populations by protecting habitats elsewhere. There is no

alternative but to protect the remaining populations of these species from further losses of individuals and habitat.

- As with other unique biodiversity within the SCA, the endemic Mt Canobolas Xanthoparmelia Lichen Community must be totally protected from development owing to its low area of occupancy and vulnerability to disturbance. There is no opportunity to offset damage to this community through reservation of areas outside the SCA.

- It testifies to the importance of the SCA for biodiversity protection that its small area of 1,672 ha supports 20 SAII entities that are considered at high risk of extinction from development. Crucially, these entities, which include all the forest and woodland vegetation in the SCA and the Silver-leaf Candlebark, occupy the entire SCA, essentially making the whole reserve subject to SAII.

- SAII entities are only allowed to be disturbed if a rigorous assessment determines that the adverse '*impact is outweighed by the social and economic benefits the development will deliver to the State*. It is highly doubtful that the benefits of a mountain biking complex on Mt Canobolas rise to State significance and justify harming these entities. The most prudent approach, using the Precautionary Principle, to conserving SAII entities is the avoidance of all harm, i.e. in the case of the Mt Canobolas SCA, there should be no mountain bike track development anywhere within the SCA.

- The above considerations clearly demonstrate that, for multiple reasons, the OCC mountain biking proposal within the Mt Canobolas SCA should not be approved. However, if the proposal were to be declared a State Significant Development, any disturbance to the SCA would require offsetting under the BC Act.

- A major impediment to offsetting is that the uniqueness of the biodiversity on Mt Canobolas means that no equivalent area of vegetation is available to use as an offset. Consequently, any loss of biodiversity from the SCA is a permanent loss and would go against the principle adopted by the NSW Government of no net loss of biodiversity from New South Wales. Essentially, the biodiversity on Mt Canobolas is irreplaceable and should not be reduced any further than it already has been.

- There is no comparable reserve in the Central West, and very few of similar size, if any, beyond the Central West, that support such an array of unique biodiversity. Without doubt the Mt Canobolas SCA is the most important nature conservation reserve in the region and must be protected in perpetuity from inappropriate development of any kind, including mountain bike development, such as proposed by OCC. In terms of potential harm to unique biodiversity there is no worse place in the region for the establishment of a mountain biking park.

Biodiversity Values, and Constraints on Development, in the Mount Canobolas State Conservation Area

INTRODUCTION

This document has been produced in response to an initial proposal by Orange City Council (OCC) to develop a large-scale mountain biking competition centre within the Mount Canobolas State Conservation Area (SCA). That proposal included a total of 63 km of exclusive mountain bike single tracks developed as 10 interconnected circuits traversing much of the SCA (Figure 1). Along with associated infrastructure, road upgrades and other facilities, it is considered highly likely such a proposal would have very significant adverse impacts on the environmental and heritage values of the SCA.

The objectives of this document are to present detailed and up-to-date site-specific scientific data on the biodiversity values of the SCA and objectively assess the biodiversity conservation values against the current environmental laws and conservation frameworks. Future reports of the CCA will address indigenous cultural heritage, and steep slopes and soils stability.

The Significant Biodiversity Values of Mt Canobolas[1]

This report provides scientific data and accurate mapping of key known sites of the following important biodiversity values on Mount Canobolas:

- Endemic and threatened flora species
- Endemic lichens and the endangered Xanthoparmelia lichen community
- Endangered ecological communities

Background

Mt Canobolas is an iconic backdrop to the City of Orange and is one of the most visited tourism destinations in Central Western NSW, famous for its spectacular views and frequent covers of snow in winter. The mountain summit (1,397 m) stands 500 m higher than the surrounding tableland and is part of the Mount Canobolas Volcanic Complex (MCVC) comprising 55 known eruption vents that were active between 12 and 11 million years ago. The volcanic lava flowed up to 80 km in all directions and at its peak Mt Canobolas is likely to have been 2,000 m higher than at present. The rich volcanic soils surrounding Mt Canobolas underpinned much of the early agricultural prosperity of Orange and currently support a vibrant local horticultural and wine tourism industry.

The rugged terrain of Mt Canobolas forestalled the clearance of native vegetation for the agricultural and forestry developments that dominate the surrounds. The central core of the mountain around the summit still retains its original cover of native vegetation preserved in the 1,672 ha SCA. The closeness of Mt Canobolas to Orange, the winter snow and its natural beauty have inspired many failed proposals over the years for tourism and recreational developments. Fortuitously, this has allowed the survival of much of the mountain's unique biodiversity. It is the last remaining significant naturally vegetated remnant of the volcanic complex.

[1] This report considers mainly the known endemic biodiversity in the SCA, which is confined to non-motile or sedentary life forms such as plants, lichens and wingless invertebrates. That is, species with poor dispersal ability. This is because the island effect created by the Mount Canobolas Volcanic Complex has only isolated populations of montane and sub-alpine plants and wingless invertebrates. Although the SCA also hosts threatened motile fauna species, none are endemic to the SCA, owing to their capacity for dispersal.

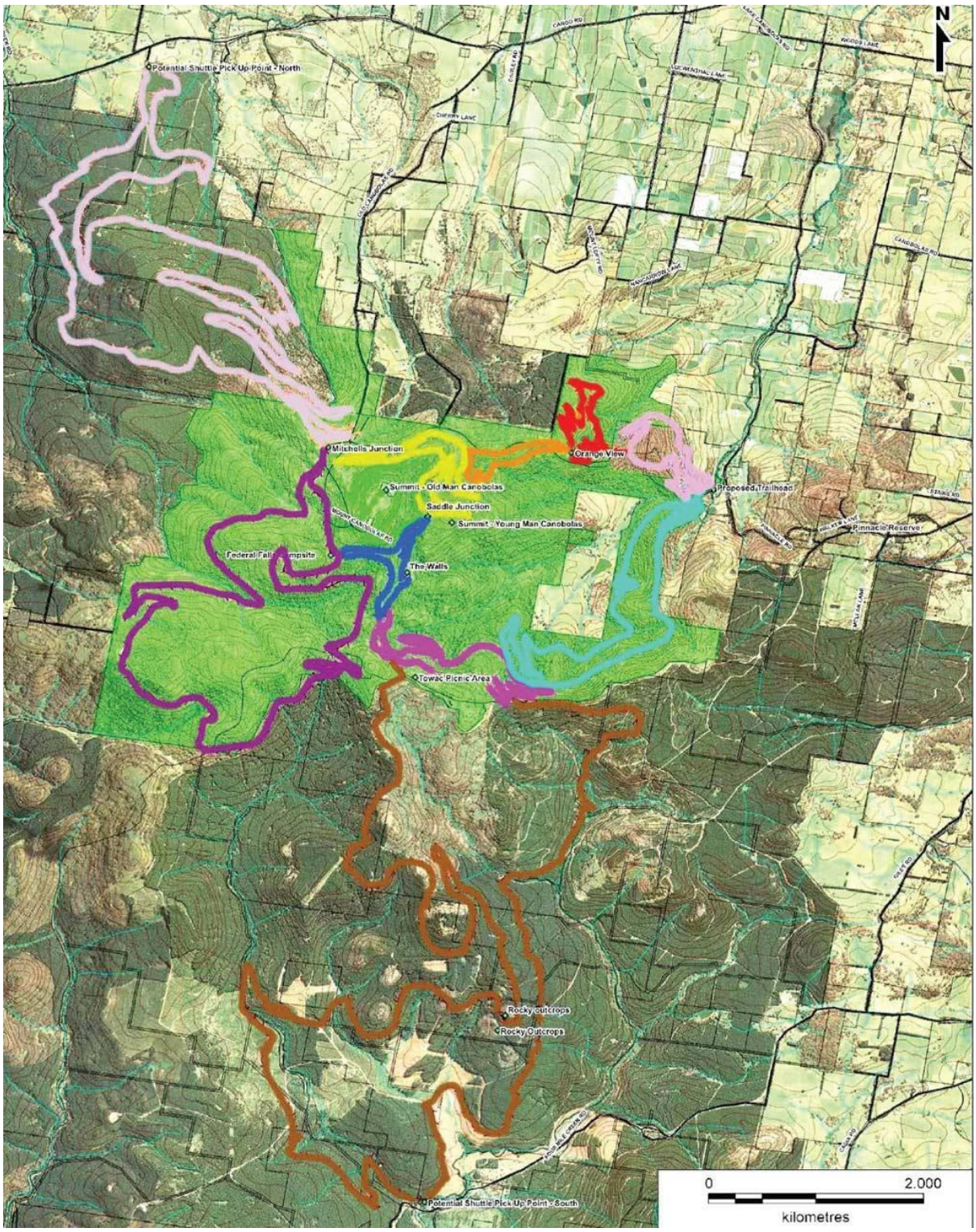

Figure 1. Mountain bike concept plan proposed by Orange City Council within and around the Mount Canobolas State Conservation Area (SCA).
[The SCA is highlighted in light green.]

Brief History of the SCA

Mt Canobolas was gazetted as a Water Reserve for travelling stock and temporary grazing, including grazing leases, from 1876 to 1958. In 1944 the area was reserved for Public Recreation and the first Trustees appointed. In 1946 the Mt Canobolas Reserve was proclaimed a Bird and Animal Sanctuary and in 1959 was listed as a Public Recreation Reserve, comprising 1,663 ha.

The Reserve was subsequently managed by a group of Trustees, as a private trust under the control of the Department of Lands. In 1992, the Department of Lands classified the Reserve as a 'Major Park'. In 1994, the Reserve became one of the parcels of land managed by the Canobolas Regional Parklands Trust, comprising ex-officio members from Government departments and Local Government, together with citizen Trustees.

After years of lobbying, the original Mt Canobolas Park was gazetted as Mount Canobolas State Recreation Area in 1997, comprising 1,672 ha of unique montane and sub-alpine landscape. In 2002, amendments to the *National Parks and Wildlife Act 1974* changed all State Recreation Areas to State Conservation Areas. OCC began investigating the potential for competition mountain biking in the SCA in 2015, despite the SCA being in Cabonne Shire and managed by the NSW National Parks and Wildlife Service.

Recognition of the Unique Biodiversity Values of the SCA

Recognition of the uniqueness of the biodiversity and cultural heritage values of the Mt Canobolas SCA has been slow to develop. Until recently, there have been very few scientific studies of biodiversity and no systematic cultural heritage surveys. Consequently, the importance of the SCA for regional nature conservation and heritage preservation is not widely appreciated. The biodiversity values of the SCA were comprehensively reviewed and collated in Medd and Bower (2019), where they also provide a new understanding of the importance of Mt Canobolas SCA as a hotspot of endemism and speciation in the NSW Central West.

Prior to 2018, the best studied botanical groups in the SCA were the eucalypts, lichens, bryophytes (mosses, liverworts and hornworts) and vascular plants, the latter two groups being the subject of specific scientific papers. Downing *et al.* (2002) provided the first documentation of the bryophytes of Mt Canobolas SCA and Hunter (2002) described the vascular plant communities and compiled plant species lists.

The first species to be recognised as unique to Mt Canobolas was the eucalypt tree now known as the Silver-leaf Candlebark, *Eucalyptus canobolensis.* Its distinctiveness was identified by Maiden in 1917, but it was not formally described until 1991, as a subspecies of *E. rubida*, by Johnson and Hill (1991), before being elevated to species status by Hunter (1998). It is listed as Vulnerable under the NSW *Biodiversity Conservation Act 2016* (BC Act) and Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Similarly, the Giles Mintbush, *Prostanthera gilesii*, was recognised as a distinct Mt Canobolas endemic by William (Bill) E. Giles in the 1940s and was only formally described in 2015 (Conn and Wilson 2015). The Giles Mintbush is listed as Critically Endangered under the BC Act. In 2019, two species of endemic orchids were described for the SCA, the Pink Spider Orchid, *Caladenia boweri*, and the Canobolas Leek Orchid, *Paraprasophyllum canobolense* (Jones 2019). Both have been nominated as threatened species.

McCarthy and Elix (2014, 2016) described four endemic species of lichens from Mt Canobolas and two other species are known only from Mt Canobolas and one other locality in Australia. The SCA conserves all known occurrences of the Mt Canobolas Xanthoparmelia lichen community, the only lichen community in Australia that is listed as Endangered (Scientific Committee 2001). One endemic fauna

species is so far known from the SCA, the Mount Canobolas Velvet Worm, *Cephalofovea pavimenta*, described in 1995 (Tait *et al*. 1995).

The recognition of multiple unique endemic taxa on Mt Canobolas has prompted increased taxonomic research into its biota, resulting in the recognition of further potential endemic plant species that have yet to be described scientifically, including a Starbush, *Asterolasia* sp.; a Phebalium, *Phebalium* sp.; a Bulbine Lily, *Bulbine petraea* (ms); and Urn Heath, *Melichrus* sp.; two other orchids, a Moth Orchid, *Diuris* sp. aff. *chryseopsis* and a Hyacinth Orchid, *Dipodium* sp. aff. *atropurpureum*, and several others. It is clear that Mt Canobolas SCA is a hotspot of endemic biodiversity that likely evolved through isolation of sub-alpine habitats on a volcanic inselberg resulting in vicariant evolution of unique life forms within the Mt Canobolas Volcanic Complex over evolutionary time (Medd and Bower 2019).

This new understanding of the Mt Canobolas SCA as a significant centre of plant speciation gives it very high importance for scientific research into the evolution and diversity of Australian plants (Medd and Bower 2019). It also highlights the likelihood that similar patterns of evolution are likely to have occurred in other groups that have yet to be studied intensively, such as other fungi and invertebrates.

Current Research

A wildfire in February 2018 that burnt over 70 percent of the SCA stimulated a series of scientific surveys aimed at monitoring the post-fire recovery of the flora and fauna. The surveys were coordinated by the NSW National Parks and Wildlife Service (NPWS), led by qualified scientists and supported by large teams of volunteer citizens and professional scientists. The work has provided much new scientific data on the distribution and abundance of rare and threatened species within the SCA. Reports on post-fire studies provided to the NPWS have been undertaken on fauna (two surveys, Kerle 2019), flora (two surveys, Porteners 2019a, 2019b) and terrestrial orchids (two surveys, Bower 2019, 2020).

Research into the taxonomy of potential new endemic flora species is ongoing and involves botanists at the University of New England led by Professor Jeremy Bruhl, orchidologist David Jones and lichenologists, Professor Jack Elix of the Australian National University and Dr Patrick McCarthy, formerly of the Australian Biological Resources Study.

2015 Constraints and Opportunities Report Commissioned by OCC

At the request of Orange City Council, consultancy firm GHD (2015) prepared a high-level constraints and opportunities report examining the potential for dedicated mountain biking tracks to be established in the SCA. However, the GHD (2015) report is now out of date and has been superseded by the introduction of the BC Act in 2016.

The report covered legislative and policy issues, environmental constraints and operational factors that would affect the feasibility of establishing tracks within the SCA. It concluded that building tracks in the SCA could be accommodated within existing government policies, strategies and guidelines for visitor use and tourism within NSW National Parks and State Conservation Areas, and provided a road map for the actions needed to achieve such an objective.

However, GHD (2015) also identified many environmental constraints including:

- The presence of three Endangered Ecological Communities in the SCA.
  - *Mount Canobolas Xanthoparmelia lichen endangered ecological community* (referred to hereafter as the Xanthoparmelia Lichen Community).

  - *Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland endangered ecological community* (referred to hereafter as the Tablelands Snow Gum Woodland Community)
  - *Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions endangered ecological community* (referred to hereafter as the Tablelands Basalt Forest Community)
- Two listed threatened flora species.
  - *Eucalyptus canobolensis*
  - *Pultenaea setulosa*
- Six flora species of 'conservation significance'.
  - *Prostanthera* Sp.C sensu Conn (1992)
  - *Asterolasia rupestris* subsp. *rupestris*
  - *Astrotricha linearis*
  - *Olearia chrysophylla*
  - *Eucalyptus saxicola*
  - *Eucalyptus perriniana*
- Sixteen actually or potentially occurring threatened fauna species.
  - Barking Owl
  - Little Eagle
  - Superb parrot
  - Little Lorikeet
  - Brown Treecreeper
  - Eastern Bent wing-bat
  - Yellow-bellied sheathtail-bat
  - Squirrel Glider
  - Yellow-bellied Glider
  - Flame Robin
  - Scarlet Robin
  - Diamond Firetail
  - Swift Parrot
  - Regent Honeyeater
  - Black-chinned Honeyeater
  - Varied Sittella
- A lack of information on the Aboriginal heritage values of Mt Canobolas.

The GHD (2015) report acknowledged the need for mountain biking tracks and associated infrastructure to avoid damage to the above natural and cultural heritage values. It included many specific recommendations for avoiding, minimising and offsetting damage to these entities, as follows.

Mount Canobolas Xanthoparmelia lichen endangered ecological community

The GHD (2015) report states: *This unique vegetation type can be readily observed and appreciated, because of its occurrence on rock ledges and outcrops. The Lichen assemblages are easily damaged by foot and bicycle traffic.*

GHD (2015) recommendations were:

- *Design the mountain bike trail network to avoid all exposed rocky areas with the potential for the EEC to occur;*
- *Actively managing unauthorised trail routes that traverse rocky outcrops by physically closing and deterring access; and*

- *Where there is no alternative to a trail crossing a rocky outcrop, construct physical barriers, platforms, drainage devices or other mitigation measures as identified through the environmental assessment process.*

Tablelands Snow Gum Woodland and Tablelands Basalt Forest Communities

The GHD (2015) report indicated: *Formal environmental assessments are required to establish if these EECs are present within the Mount Canobolas SCA, and if so, the likely potential impacts and mitigation measures associated with the construction and operation of new mountain bike trails within the reserve. This may include vegetation off-setting where there is a need to remove individual trees for construction access or track alignment.*

Threatened Flora Species

No recommendations for avoidance, mitigation or offsetting were made in the GHD (2015) report for any of the threatened or 'conservation significant' flora species, except for the Silver-leaved Candlebark (*Eucalyptus canobolensis*). The report indicated that the Silver-leaf Candlebark is widespread in the SCA, that individuals would be difficult to avoid in track building and that offsetting would likely be necessary. Proposed offsetting was '*plantings used to link, enhance or establish additional populations*'.

Fauna

The GHD (2015) report indicated a mountain bike track network may impact 16 actual or potential threatened native fauna species or their habitats. Impacts may include:

- *Track construction and maintenance may result in the loss of hollow-bearing trees, loss of tall trees or reduction in mid storey and undergrowth (where it is not possible to provide an alternative track route around these features).*
- *Tree removal or vegetation clearing can include pre-clearing fauna surveys.*
- *Offsetting of any clearing can be achieved through activities such as offset plantings, weed management, or the installation of habitat boxes.*

The report recommended the following avoidance, mitigation and offset strategies:

- *The track route should avoid all tall trees in areas in which this species (the Little Eagle) is recorded or likely*
- *All large tall trees with large hollows (of seven actual or potential hollow-dwelling threatened fauna species) are conserved, and the track is located outside the canopy area to limit potential compaction and limb-fall issues. Habitat boxes can be installed to supplement tree hollows.*
- *…more detailed surveys and assessment may identify species specific habitat preferences (of seven other fauna species) which may require further consideration in relation to a proposed mountain bike track network.*
- *Offsetting of any clearing can be achieved through activities such as offset plantings, weed management, or the installation of habitat boxes.*
- *Ongoing monitoring of any large hollow trees or identified habitat adjoining the track can also be implemented in case during track use, compaction or other issues start to impact tree health.*

Comments on the GHD Report

The GHD (2015) report presented an understanding of the biodiversity of Mt Canobolas SCA as it was known at the time. Since then, much more has been learnt about the biodiversity of the SCA. In

particular, there have been a number of changes to the interpretation of some of the flora species that affect the findings of the report. These include:

- *Pultenaea setulosa* – The Commonwealth listing of the species as Vulnerable applies only to populations in Queensland and the Nandewar region of NSW. Whilst the NSW Herbarium (Royal Botanic Gardens and Domain Trust, Sydney) includes *Pultenaea* sp. 'F' on Mt Canobolas as part of *P. setulosa*, the Commonwealth listing does not. Accordingly, the population of *P. setulosa* on Mt. Canobolas is not part of the listed threatened species.
- *Prostanthera* sp. C is now known as *P. gilesii* (Conn and Wilson 2015) and is listed as Critically Endangered.
- *Astrotricha linearis* and *Olearia chrysophylla* were included by GHD (2015) as species of 'conservation significance', based on the opinion of Hunter (2002). This characterisation of the two species was not wholly supported by Medd and Bower (2019). *Astrotricha linearis* is doubtfully present in the SCA and the significance of the *Olearia chrysophylla* occurrence requires further investigation as there is some uncertainty about its taxonomic status.
- *Eucalyptus saxicola* is no longer recognised as a distinct species having been synonymised with *E. bridgesiana*. Despite referring to this, GHD (2015) maintained it as a species of 'conservation significance'.
- *Eucalyptus perriniana* was recorded by GHD (2015) as a species of 'conservation significance', but it is now recognised that the plants of this species on the summit are cultivated specimens.

WHY THIS NEW REPORT IS NECESSARY

This Values and Constraints report is necessary for two principal reasons:

- The regulatory framework for biodiversity assessment has changed since 2015 with the gazetting of the *Biodiversity Conservation Act* (BC Act) in 2016.

- A great deal more specific information has been obtained about the biodiversity of Mt Canobolas SCA since the GHD (2015) report was issued.

Using information gained in surveys over the last two years and the recent published literature, this report provides specific detail on currently known locations of rare and threatened species and vegetation communities

NEW ASSESSMENT APPROACHES

The previous constraints report by GHD (2015) was written before the BC Act replaced the *Threatened Species Conservation Act (1995)* in 2016. The BC Act was a wide-ranging overhaul of biodiversity management in NSW, containing a number of new provisions and methodologies that affect the recommendations made by GHD (2015) in relation to the OCC mountain biking proposal in Mt Canobolas SCA. The relevant new provisions include the concepts of Areas of Outstanding Biodiversity Value (AOBV) and Serious and Irreversible Impacts (SAII). The changes in methodology flow from the introduction of the Biodiversity Assessment Method (BAM) to measure environmental impacts and establish offset requirements. The implications of the new approaches for the Mt Canobolas SCA mountain bike proposal are discussed below in relation to our current understanding of the uniqueness of the biodiversity on the mountain.

Area of Outstanding Biodiversity Value (AOBV)

AOBVs are special areas with irreplaceable biodiversity values that are important to the whole of NSW, Australia or globally (DPIE 2020a). The BC Act gives the Minister for the Environment the power to declare AOBVs in order to highlight and effectively manage sites that make significant contributions to the persistence of biodiversity.

Mt Canobolas State Conservation Area was nominated for AOBV status in May 2018 (Medd and Bower 2018). The nominees have been advised in correspondence with DPIE that the Mt Canobolas SCA nomination was used as a test of the guidelines for listing criteria for AOBVs. The advice further states ... "*the department will commence consultation with the landholder, National Parks and Wildlife Service, and relevant public authorities such as the local council on the Mount Canobolas proposal. The local community will also be consulted in due course*." The inference is that the nomination is to proceed to community consultation (DPIE 2020a). It is now over 2.5 years since the nomination was made and public display and consultations have yet to commence. The slow determination of this nomination has been attributed to several factors including the time taken to develop an evaluation process and publication of guidelines, which has still not occurred, as well as the 2019/20 bushfire season and the Covid-19 pandemic. In any event, the most important outcome so far is the recognition by DPIE that the Mt Canobolas SCA meets the criteria for consideration as an AOBV. Accordingly, it is considered that any assessment of development proposals within the SCA should recognise that it meets the criteria for an AOBV.

Developments within an AOBV must be assessed using the Biodiversity Assessment Method and the Biodiversity Offsets Scheme rather than a Five Part Tests as required for a Review of Environmental Factors for developments approved under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Although the AOBV status of the Mt Canobolas SCA has not yet been officially recognised, the precautionary principle (see below) mandates that activities in the SCA should be assessed on the basis that it has been recommended for Preliminary Determination.

Serious and Irreversible Impacts (SAII)

'*The concept of serious and irreversible impacts is fundamentally about protecting threatened entities that are most at risk of extinction from potential development. The Biodiversity Offsets Scheme recognises that there are some types of serious and irreversible impacts that the community expects will not occur except where the consent authority considers that this type of impact is outweighed by the social and economic benefits that the development will deliver to the State'* (DPIE 2020b).

Clause 6.7 of the *Biodiversity Conservation Regulation 2017* sets out four principles for SAII. An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because:

1. *it will cause a further decline of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline*
2. *it will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size*
3. *it is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution*
4. *the impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.*

The Precautionary Principle

Environmental policy and legislation in Australia are guided by the Precautionary Principle.

The Precautionary Principle was conceived as a means to ensure that decision makers take into account uncertain but potentially serious and/or irreversible threats of harm (Peterson 2006). The Precautionary Principle has been defined in various ways depending on the situation to which it is being applied (Peterson 2006). Following are two formulations related to biodiversity protection.

> *In line with the precautionary principle, where interactions are complex and where the available evidence suggests that there is a significant chance of damage to our biodiversity heritage occurring, conservation measures are appropriate, even in the absence of conclusive scientific evidence that the damage will occur* (JNCC 1994).
>
> *Prevent harm as the best method of environmental protection and, when knowledge is limited, apply a precautionary approach. Take action to avoid the possibility of serious or irreversible environmental harm even when scientific knowledge is incomplete or inconclusive. Place the burden of proof on those who argue that a proposed activity will not cause significant harm, and make the responsible parties liable for environmental harm* (Earth Charter 2000).

The uncertainty surrounding potential threats to the environment has frequently been used as a reason to avoid taking action to protect the environment. The Precautionary Principle recognizes that delaying action until there is compelling evidence of harm will often mean that it is then too costly or impossible to avert the threat. Use of the principle promotes action to avert risks of serious or irreversible harm to the environment in such cases. The Principle provides a fundamental policy basis to anticipate, avoid and mitigate threats to the environment (IUCN 2007).

In the case of a reserve such as the Mt Canobolas SCA that is recognised as important for conservation of unique biodiversity, particularly since it is dedicated for that purpose, the Precautionary Principle holds that where there is a risk of harm to biodiversity and alternatives are available for the activity, the activity should not go ahead. The Precautionary Principle should be applied to those parts of the SCA that have not been the subject of detailed surveys historically and where the timing, seasonal conditions or life histories of biota mean that there is uncertainty as to their presence or absence following targeted surveys for a Development Approval. Examples of entities to which the Precautionary Principle should apply include orchids that do not flower every year, plants that do not germinate and grow in drought conditions and plants that only reliably grow and reproduce after fire.

The Mitigation Hierarchy

A key tool for sustainable development is the mitigation hierarchy which provides a framework for minimising environmental harm when planning new developments. To the detriment of biodiversity, there are still many development proposals that fail to adequately take environmental considerations into account at the early stages of planning.

One of the first steps in site evaluation for developments should be gaining a thorough understanding of site constraints. A constraints report for the mountain biking proposal was commissioned by Orange City Council (GHD 2015), however it was a very general document based on the scant information available at the time. It lacked the detail necessary to provide guidance to the track designers about the precise locations of rare and threatened species and endangered vegetation communities that should be avoided. As a consequence, tracks have been placed across multiple areas of key habitat for the many rare and threatened entities that occur on the mountain.

The environmental assessment of the mountain bike proposal should employ the mitigation hierarchy of:

- **AVOID**
- **MINIMISE**
- **OFFSET**

Avoid

Avoidance of impacts on entities that should not be disturbed is the first step in development planning. It involves ensuring that infrastructure, buildings or other assets are placed to completely avoid impacts on the 'things that we should keep' (Hope 1974). In ignorance, the current mountain bike proposal for Mt Canobolas fails to avoid large areas where impacts to multiple biological entities of conservation significance occur.

Minimise

If disturbance to important entities cannot be avoided, it is then incumbent on the developer to minimise the duration, intensity and/or extent of impacts (including direct, indirect and cumulative impacts). No minimisation strategies have been outlined in Orange City Council's mountain bike proposal. Indeed, the proposal is not framed as an environmental assessment at all.

Offset

One of the key principles of sustainable development adopted by all Australian governments is that there should be no net loss of biodiversity due to development activities (IUCN 2016). Accordingly, where, after employing avoidance and minimisation strategies, disturbance to important biodiversity values would still occur, the development proponent must compensate fully for the loss by providing 'offsets'. The NSW *Biodiversity Conservation Act 2016* provides a mechanism, the Biodiversity Assessment Method (DPIE 2020c) for calculating a value for biodiversity loss and several mechanisms for offsetting that loss. This report will examine both the feasibility of offsetting the Council's proposal and the magnitude of offsetting required, which will demonstrate that offsetting is impossible owing to a lack of equivalent land for offsetting and is likely to be extremely costly.

However, the mitigation hierarchy cannot be employed successfully if the understanding of the constraints is incomplete as in GHD (2015). This report aims to provide scientific data and precise locations of the biodiversity and habitats that should be avoided, thereby allowing a fuller assessment to be made of the environmental costs of the proposal.

The Importance of Habitat Protection

Environmental legislation recognises the importance of habitat protection as being critical for the conservation of threatened species and biodiversity in general. This is based on the truism that survival of species depends not only on preventing harm to individuals but on protection of the habitats in which they live and the resources they depend upon for food, shelter and reproduction. Areas of protected habitats also need to be large enough to support viable populations of species in perpetuity. Populations must be of sufficient size to withstand and recover from adverse weather events, catastrophes such as storms and fires, and to maintain sufficient genetic diversity to avoid inbreeding. It is considered that many populations of species on Mt Canobolas are likely to be close to their minimum thresholds for viability owing to already low population sizes, which in turn is due to the small size of the SCA (1672 ha). In essence, many species in the SCA cannot withstand further losses of habitat from developments, such as the mountain biking proposal, and the inevitable additional debilitating disturbances that would accompany it.

Accordingly, this report identifies not only the locations of individual records of threatened plant species and communities, but also the areas of habitat they occupy and protective minimum buffer zones that should be established around them. Current ecological theory includes the concept of metapopulations which recognises that within overall areas of suitable habitat, sub-populations of species wax and wane over time, flourishing in some areas before dying out, only to rise in other areas where they had been absent. This means that even though individuals of a species may not be present in a particular area at the time of a survey, that area may nonetheless be important as potential future habitat to maintain the metapopulation. Habitat areas and buffers necessary to maintain threatened species in the SCA are discussed further in the next section.

Section 7.3 of the BC Act describes the application of Five Part Tests of Significance to determine if a development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. Part C of the tests covers habitat considerations, as follows;

'In relation to the habitat of a threatened species or ecological community:

i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and

iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.'

Buffer Zones

Avoidance of damage to important biodiversity sites requires the establishment of undisturbed buffer zones around sites. There appear to be no established guidelines for buffer zones in NSW or nationally and very few globally. In most cases, buffer zones are set appropriate to the local situation and the action proposed to be undertaken (DER 2014, PIFWO 2016). In the literature, buffers around individual plants vary from 1 m to 250 m (PIFWO 2016) and 200 to 700 m for populations and ecological communities (Liddle *et al*. 2008, USDC Colorado 2015). PIFWO (2016) set buffers as low as 1 m for hand operations such as pruning and weeding, 100 m for heavy machinery or boom spraying and 250 m for farming or forestry activities near individual plants. Human walking trails were set at a minimum buffer of 6 m for herbs or shrubs and twice the crown diameter for trees (PIFWO 2016).

Given the proposed activities in the OCC mountain biking proposal it is recommended that minimum buffers of 50 m be set for individual plants, populations, habitat areas, threatened ecological communities and orchid hotspots. It is considered such buffers are necessary to avoid damage from mountain bike groups that stop and congregate beside tracks, spreading into and flattening the vegetation, but more importantly for the high probability that spectators will walk beside tracks and move across country to viewing points. Buffer zones of 50 m are used in this report.

GENERAL METHODS

Field Searches

Formal flora surveys of the SCA have been conducted by Hunter (2002) and Porteners (2019a, 2019b). Informal botanical searches of the SCA to create flora lists and document rare and threatened species have been conducted over many years by RW Medd. Citizen science surveys for terrestrial orchids led

by CC Bower were conducted after the February 2018 wildfire in the springs of 2018 and 2019, and autumn 2019, by groups of volunteers (Bower 2019, 2020). The orchid searches used the transect methodology in the *NSW Guide to Surveying Threatened Plants* (DPIE 2020d). Searchers walked in straight line transects approximately 10 m apart in suitable habitat during the flowering season (Bower 2019, 2020).

Comprehensive fauna surveys using qualified scientific leaders, assisted by volunteers, using a variety of methodologies were coordinated by Dr Anne Kerle in autumn and spring 2019 (Kerle 2019).

Field Data Collection

Specific field location data reported herein were generally collected with hand held GPS units, e.g. Garmin GPSMap 64s. These are accurate to approximately 10 m (Garmin 2018). These or similar units were used for individual orchid and fauna records.

Individuals of two rare or threatened orchid species, *Caladenia fitzgeraldii* and *Paraprasophyllum canobolense*, were permanently tagged for long term monitoring (Bower 2019, 2020). More accurate locations (0.1 to 0.4 m) of these species were obtained with a Trimble Catalyst differential GPS unit.

Most data have been entered into the NSW BioNet database although state wildfire and Covid-19 disruptions have prevented the completion of this task with regard to orchids and microbats.

Mapping

The distribution maps in this report were prepared using the QGIS Geographic Information System software on a portable computer.

The mapping does not give precise locations of some rare or threatened entities with very small populations, or highly restricted distributions, in order to safeguard against loss or damage to individuals through illegal collection or unintentional damage by curious visitors. Instead, the mapping provides accurate delineation of the habitats in which the rare or threatened entities are known to occur with a minimum buffer zone of 50 m around the habitat zone. These buffered zones represent protection areas to prevent damage to individuals, populations and habitat. This approach has been adopted because habitat integrity is essential to maintain populations of threatened or endemic species, such as orchids, lilies and lichens. A criss-crossing network of mountain bikes tracks through the habitat of a threatened entity, while it may avoid the locations of known individuals, nevertheless removes and fragments habitat, and disrupts metapopulation dynamics, whilst also potentially impacting unrecorded individuals.

Limitations of the data

It should also be noted that the mapping represents only our current knowledge of the distribution and habitats of the rare and threatened entities that are currently recognised in the SCA. Further survey would undoubtedly reveal more populations of currently recognised endemic entities in the less explored parts of the SCA. In addition, further taxonomic research is likely to discover more, perhaps many more, unrecognised endemic species within the SCA.

Many of these taxa exist as small relict populations occupying only a small part of the potentially suitable habitat in the SCA. No attempt has been made to identify the extent of potential habitat for these species. Such potential habitat represents areas that could be needed in future for the establishment of cultivated specimens as part of programs to increase the populations of threatened species and for natural dispersal of species into new areas as part of their metapopulations in the SCA.

THE SIGNIFICANT BIODIVERSITY OF THE MOUNT CANOBOLAS SCA

Vegetation Communities

Hunter (2002) identified and mapped seven vegetation communities in Mt Canobolas SCA (Table 1, Figure 2). Since Hunter's (2002) paper was published a state-wide vegetation classification system of Plant Community Types (PCT) has been developed (BioNet 2020). Medd and Bower (2019) attempted to match the vegetation communities identified by Hunter (2002) with the nearest PCT defined in the state-wide classification (Table 1). For some vegetation communities (2, 4 and 7) there was no close equivalent PCT and the match for Community 1 was relatively poor (Table 1). Most communities within the Mt Canobolas SCA differ from similar vegetation types in the state-wide classification owing to the dominant presence of the Silver-leaf Candlebark, *Eucalyptus canobolensis*, which is endemic to the Mount Canobolas SCA and immediate surrounds. It is also absent from similar vegetation in montane and sub-alpine habitats on the Great Dividing Range to the east. Further, some tree species that are dominant in similar vegetation on the Great Dividing Range are absent from the Mt Canobolas SCA (Medd and Bower 2019). Consequently, the vegetation of Mt Canobolas SCA is distinctive and of considerable scientific importance. It is therefore highly probable that future studies will recognise localised endemic, threatened PCTs in the SCA.

The outcrop heathland (Community 2) and outcrop woodland (Community 4) communities of Hunter (2002) are highly distinctive with no equivalents in the state-wide vegetation classification and are likely to represent a new PCT of highly restricted distribution that would qualify as threatened.

Threatened Ecological Communities

The forest and woodland vegetation covering the entire area of the Mt Canobolas SCA belongs to one or other of three threatened ecological communities listed under the BC Act (Figure 3). Vegetation consistent with three threatened ecological communities is present (Table 3). They are:

1. *Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions Endangered Ecological Community* (Tableland Basalt Forest).
2. *Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion Critically Endangered Ecological Community* (Werriwa Tablelands Grassy Woodland).
3. *Monaro Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion Critically Endangered Ecological Community* (Monaro Tablelands Grassy Woodland).

Tableland Basalt Forest Endangered Ecological Community

The Tableland Basalt Forest EEC is very widespread across the SCA (Figure 3). Two communities defined by Hunter (2002) conform to the Tableland Basalt Forest EEC: Community 1 and Community 3 (Table 3). Both are forests with Mountain Gum, *Eucalyptus dalrympleana*, and Snow Gum, *E. pauciflora*, and various other species. Community 3 as defined by Hunter (2002) includes two sub-communities; one occurring on lower slopes said to be dominated by Mountain Gum and Ribbon Gum, *E. viminalis*, and another on upper slopes and ridgetops dominated by Snow Gum and Silver-leaf Candlebark, *E. canobolensis*. These two sub-communities can be assigned to different threatened communities; the tall forests of the gullies, lower slopes and steep sheltered south-facing slopes of the SCA are considered to be part of the Tableland Basalt Forest EEC.

Werriwa Tablelands Grassy Woodland Critically Endangered Ecological Community

The grassy woodland areas of Mt Canobolas SCA that are dominated by Snow Gums and Silver-leaf Candlebarks are considered to be part of the Werriwa Tablelands Grassy Woodland CEEC. These

include all of Hunter's (2002) Community 5 and the part of his Community 3 that occurs on upper slopes and crests within the SCA (Table 3). This CEEC occurs extensively in the SCA on upper slopes, ridgetops and crests at the higher altitudes (Figure 3).

Monaro Tablelands Grassy Woodland Critically Endangered Ecological Community

The Monaro Tablelands Grassy Woodland CEEC is represented in the SCA by Hunter's (2002) Community 6 (Table 3). Community 6 comprises small areas along semi-permanent incised watercourses, including Towac Creek (Figure 3).

Since most of the SCA is covered by threatened ecological communities (Figure 3), any mountain bike track network would impact on them.

Table 1. Vegetation Communities Recognised in the Mt Canobolas SCA[1]

No.	Hunter (2002)	Dominant Eucalypts and/or shrubs	Nearest PCT[2]	EEC[3]/CEEC[4]	Comment
1	Stringybark – Peppermint Shrubby Open Forests and Woodlands	*Eucalyptus macrorhyncha, E. canobolensis, E. dives, E. dalrympleana*	730. Broad-leaved Peppermint - Mountain Gum dry open forest of the Central Tablelands area of the South Eastern Highlands Bioregion	Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions EEC	Although PCT 730 is closest to community 1, it is a dry forest type with sparser grass cover than the moist community on Mt Canobolas.
2	Outcrop Heaths and Shrublands	*Mirbelia oxylobioides, Calytrix tetragona, Kunzea parvifolia, Phebalium* sp.	N/A	-	No currently listed PCTs resemble this community.
3	Snow Gum – Mountain Gum Grassy Woodlands and Tall Open Forests	*E. pauciflora, E. dalrympleana*	1197. Snow Gum – Mountain Gum tussock grass-herb forest of the South Eastern Highlands Bioregion	Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions EEC (in part), and Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion CEEC (in part).	The characterisation of this community by Hunter (2002) includes several tree species that do not occur in the SCA, including *E. mannifera*, *E. radiata*, *E. polyanthemos* and *Acacia irrorata*.
4	Outcrop Low Open Woodlands	*E. canobolensis, E. bridgesiana / Mirbelia oxylobioides, Calytrix tetragona, Phebalium* sp.	N/A	-	This community occurs on similar sites to community 2, albeit with slightly more soil and scattered tree cover. No currently listed PCTs resemble this community.
5	Grasslands and Grassy Open Woodlands	*E. pauciflora, E. canobolensis, E. dalrympleana*	1197. Snow Gum – Mountain Gum tussock grass-herb forest of the South Eastern Highlands Bioregion	Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion CEEC[3].	
6	Disturbed Creek-lines	*E. viminalis, E. stellulata, E. pauciflora*	1191. Snow Gum – Candlebark woodland on broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	Monaro Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion CEEC[3].	
7	Waterfall Low Open Woodlands	Minor *E. goniocalyx*, *E. canobolensis*	N/A	-	A minor community related to communities 2 and 4.

[1] (Hunter 2002, Medd and Bower 2019)

[2] PCT = Plant Community Type (BioNet 2020)

[3] EEC = Endangered Ecological Community listed under the *Biodiversity Conservation Act 2016.*

[4] CEEC = Critically Endangered Ecological Community listed under the *Biodiversity Conservation Act 2016.*

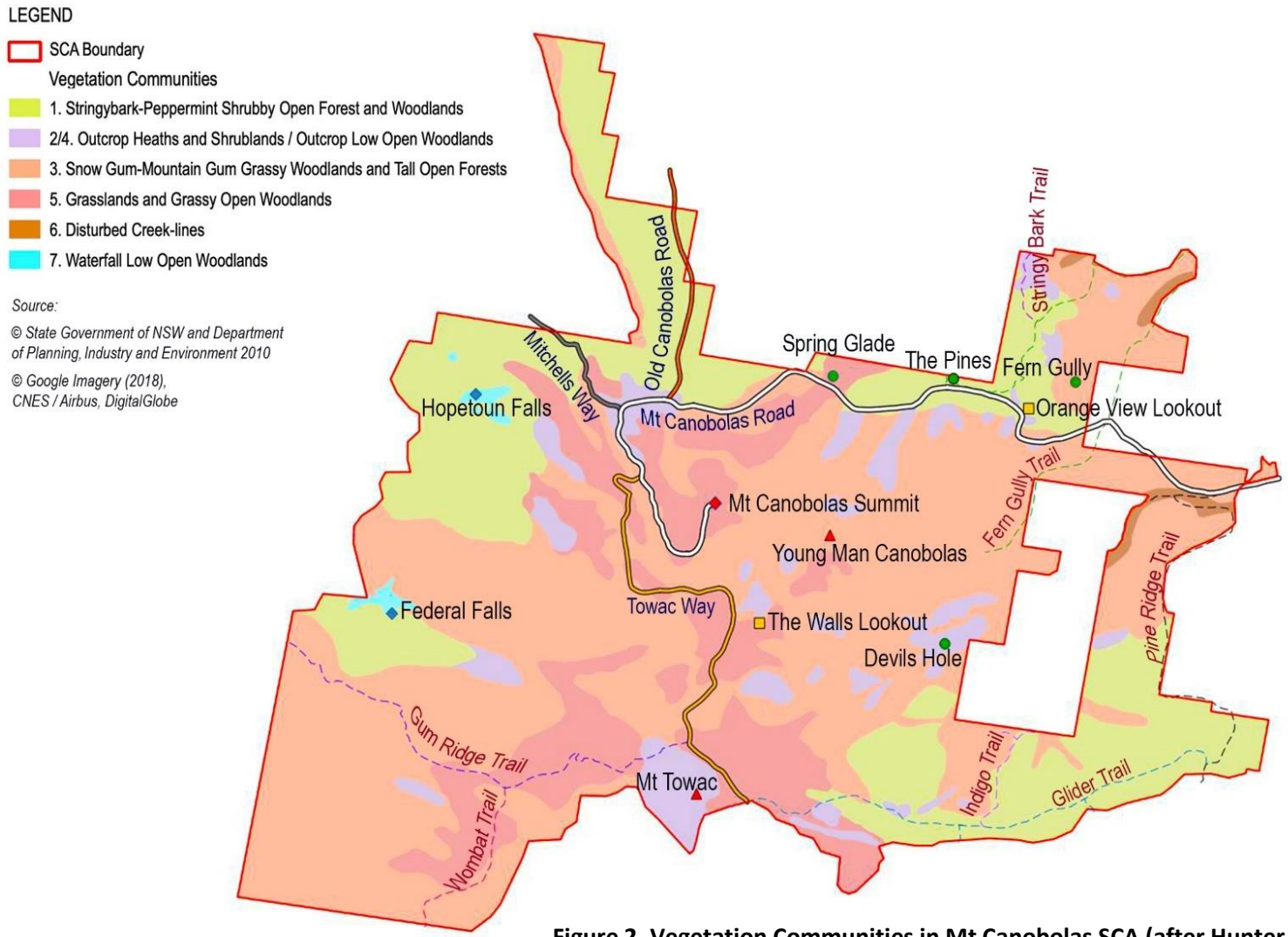

Figure 2. Vegetation Communities in Mt Canobolas SCA (after Hunter (2002)

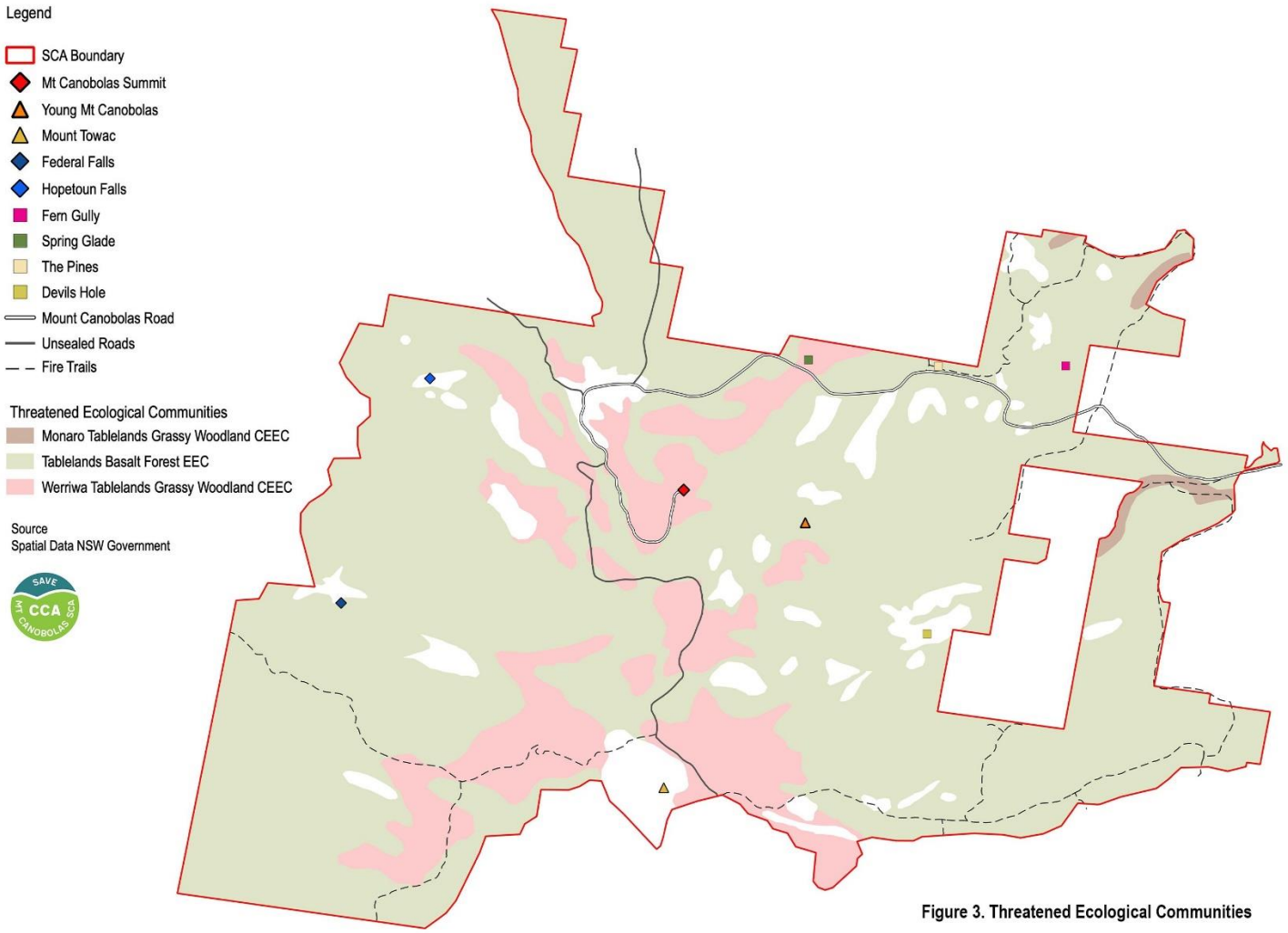

Figure 3. Threatened Ecological Communities

The Unique Heathlands of Mt Canobolas

Hunter (2002) noted that his Community 2 (Outcrop Heaths and Shrublands) was likely restricted to Mt Canobolas SCA and near surrounds. This community and the very similar Community 4 do not match any PCTs in the NSW state-wide vegetation classification (Table 1) and are unique to the Mt Canobolas Volcanic Complex. The occurrences are restricted to rock outcrops, rock plates and areas of shallow soil scattered through the SCA (Figure 4). It is considered that outcrop heaths, shrublands and woodlands are likely to be recognised as a distinct PCT in the future and that it would qualify for listing as threatened under the BC Act.

FLORA

Actual and Nominated Threatened Species

Medd and Bower (2019) documented the endemic and threatened flora species so far known within the Mt Canobolas SCA (Table 2). There are now four described endemic flora species, two of which, *Prostanthera gilesii* and *Eucalyptus canobolensis* are listed as threatened (Table 2). The other two are orchids, *Caladenia boweri* and *Paraprasophyllum canobolense*, described in 2019 (Jones 2019) that were nominated as threatened in 2020. One other significant described orchid species occurs in the SCA, *Caladenia fitzgeraldii*, whose SCA population is considered to be significant, declining and was nominated as Endangered in 2019. This nomination is still being processed, but has been revamped by the NSW Scientific Committee to consider the species as a whole as threatened rather than just the SCA population.

Table 2. Confirmed Endemic and Threatened Flora Species in the Mt Canobolas SCA

Family Name	Scientific Name	Common Name	Endemic?	Conservation Status	
				BC Act	EPBC Act
Lamiaceae	*Prostanthera gilesii*	Giles Mintbush	✓	CE	-
Myrtaceae	*Eucalyptus canobolensis*	Silver-leaf Candlebark	✓	V	E
Orchidaceae	*Caladenia boweri*	Pink Spider Orchid	✓	(CE)[1]	(CE)[1]
	Caladenia fitzgeraldii	Fitzgerald's Spider Orchid	X	(E)[1]	-
	Paraprasophyllum canobolense	Canobolas Leek Orchid	✓	(E)[1]	(E)[1]

[1]..Nominated for threatened species status

Endemic Species

Six other flora taxa have been putatively identified as undescribed endemic species in the SCA by specialists (Table 3). One has a manuscript name, *Bulbine petraea* (ms) and is expected to be published in the near future. The other five are variants of more widespread forms and are under investigation as potential new endemic species in the SCA. With the exception of the *Phebalium*, which is relatively widespread in rock plate heaths in the SCA, the other species have very small populations and are considered to be Endangered or Critically Endangered. The *Phebalium* is considered likely to qualify for listing as Vulnerable.

Table 3. Putative Undescribed Endemic Flora Species in the Mt Canobolas SCA

Family Name	Scientific Name	Common Name	Endemic?
Asphodelaceae	*Bulbine petraea* (ms)	Canobolas Rock Lily	✓
Epacridaceae	*Melichrus* sp. aff. *urceolatus*	An Urn Heath	✓
Orchidaceae	*Dipodium* sp. aff. *atropurpureum*	A Hyacinth Orchid	✓
	Diuris sp. aff. *chryseopsis*	A Moth Orchid	✓
Rutaceae	*Asterolasia* sp. aff. *rupestris*	A Starbush	✓
	Phebalium sp. aff. *squamulosum*	A Phebalium	✓

Figures 5 to 9 give the locations of buffered habitat patches of threatened and endemic flora species for which there is good information. The locations of very rare species are not given to protect them from illegal collection activity and other threats such as disease introduction.

Giles Mintbush

Giles Mintbush is one of the rarest and most endangered plants in NSW. Its only known populations were severely impacted by the wildfire of 2018 and it has been assigned to the NSW Saving Our Species program. The locations of Giles Mintbush populations are being withheld owing to its high vulnerability. However, the NPWS has excluded its habitat from consideration for mountain biking or any other development in the Plan of Management for the SCA.

Silver-leaf Candlebark

The Silver-leaf Candlebark is the signature tree species of Mt Canobolas. It is a distinctive species that gives the mountain a characteristic 'look' not seen beyond the region, NSW or globally. It is especially prominent since the wildfire of 2018, which caused epicormic buds to sprout on tree trunks and branches, showcasing the large silvery-blue juvenile leaves. Silver-leaf Candlebark is widespread across the entire SCA (Figure 5), occurring in five of the seven communities recognised by Hunter (2002); Communities 1, 3, 4, 5 and 7.

A targeted strategy for managing this species has been developed under the NSW Saving Our Species program.

An important characteristic of the Silver-leaf Candlebark is its propensity to form hollows. It consequently is a highly significant resource and habitat for hollow-nesting birds and arboreal mammals such as gliders and microbats.

Since it is distributed commonly through most of the SCA (Figure 5), it is likely to be impacted by any mountain bike track development. Because the entire natural population is confined to the Mount Canobolas Volcanic Complex it is highly vulnerable to threats such as the introduction of diseases.

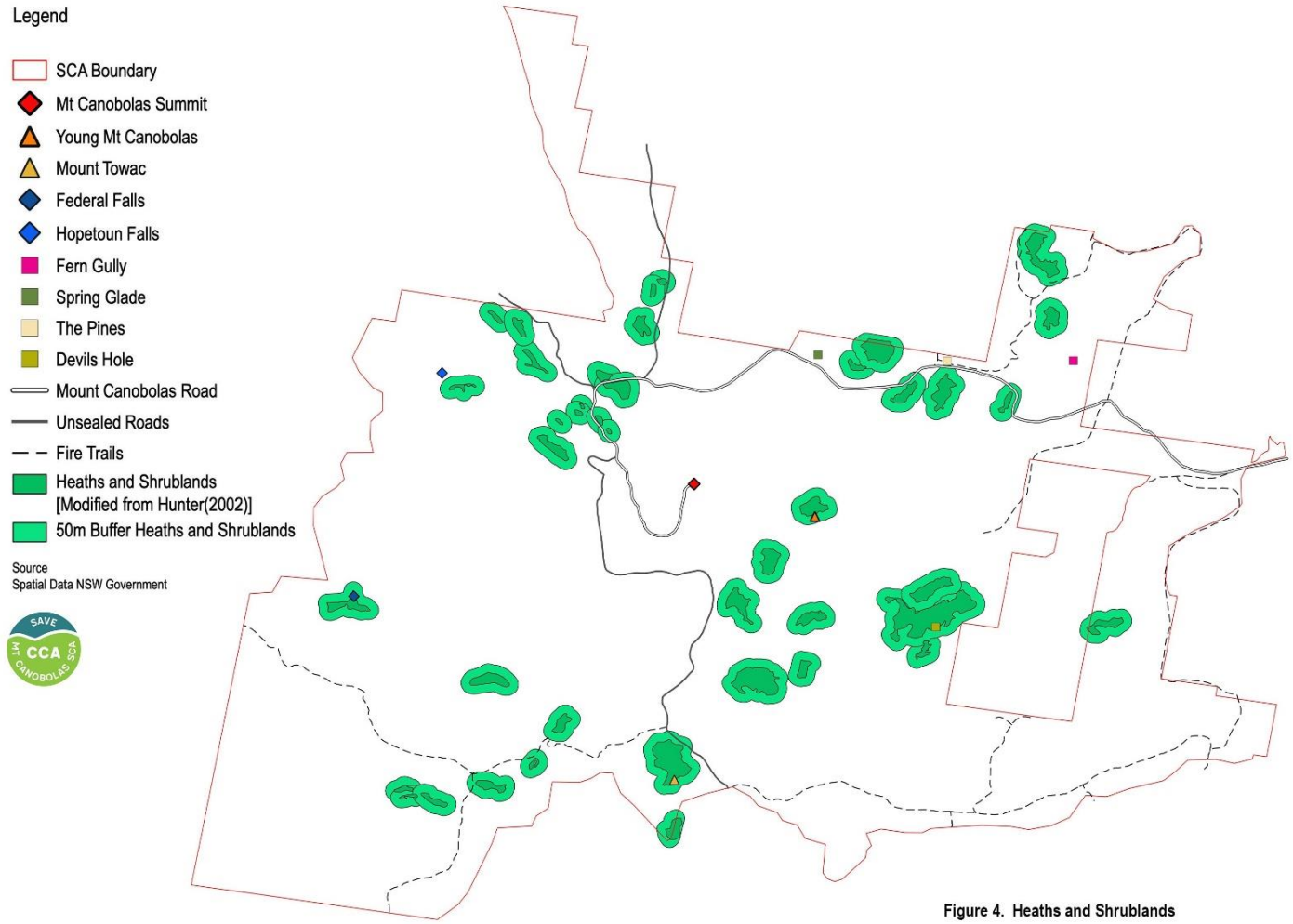

Figure 4. Heaths and Shrublands

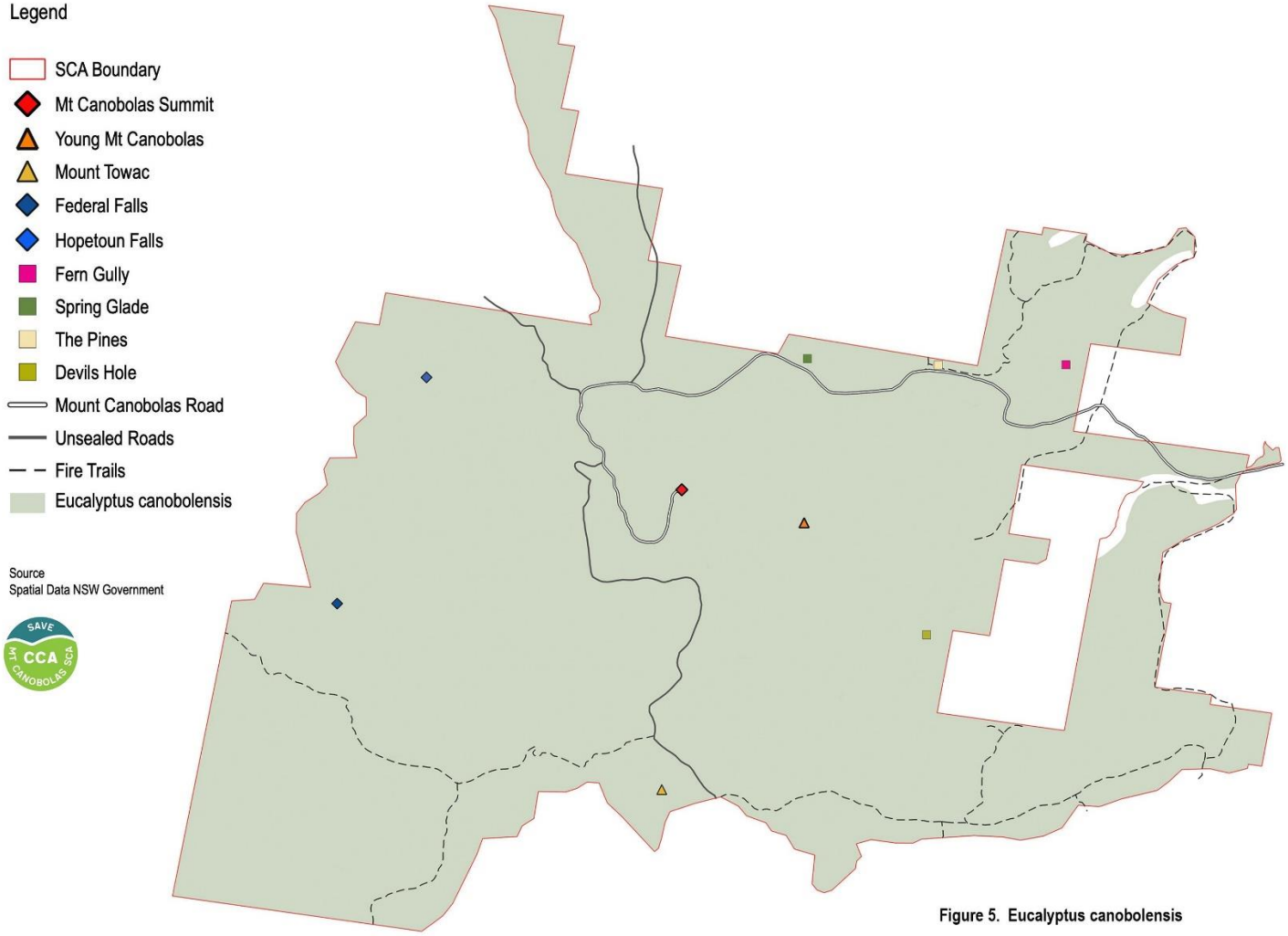

Figure 5. Eucalyptus canobolensis

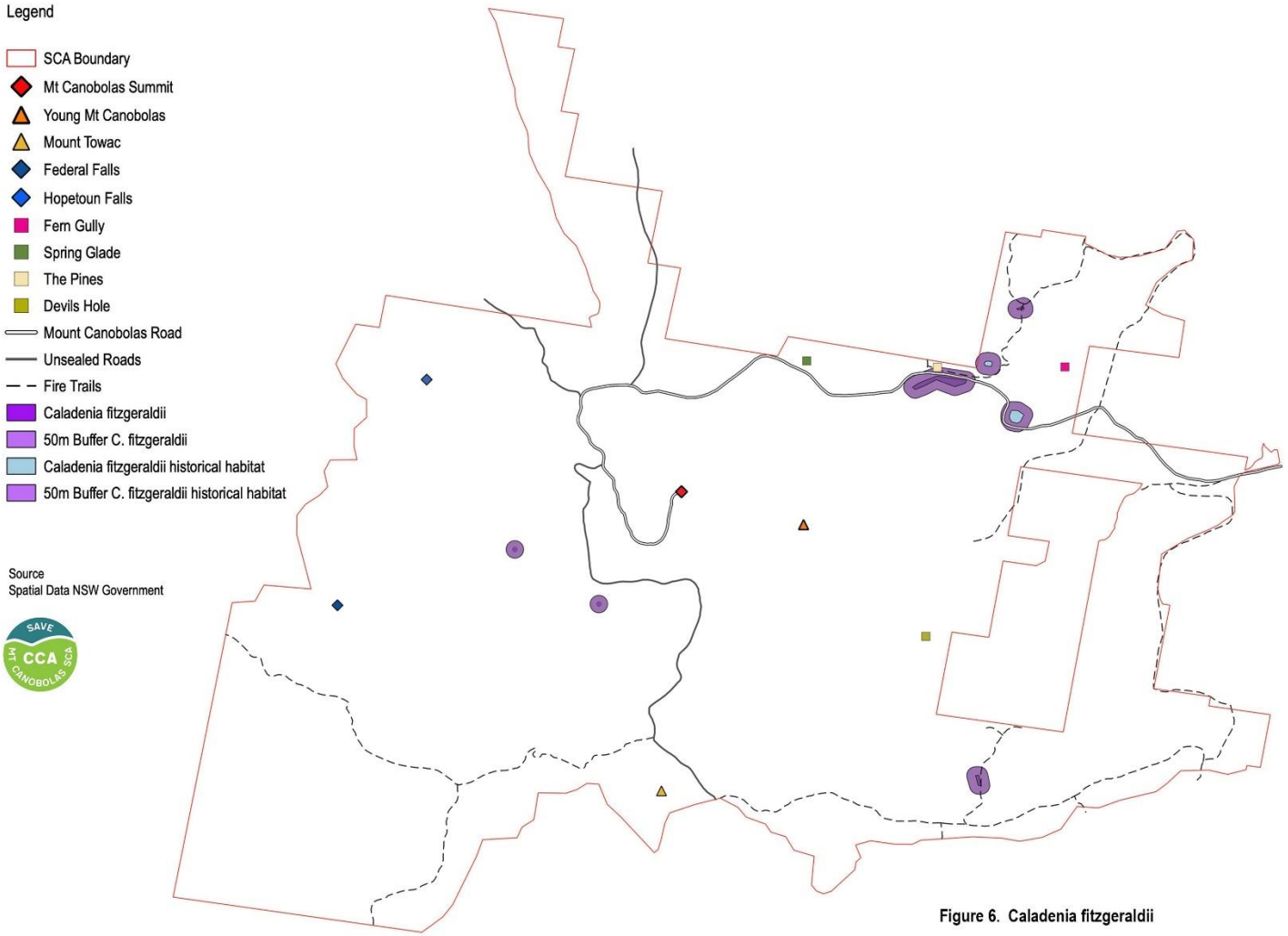

Figure 6. Caladenia fitzgeraldii

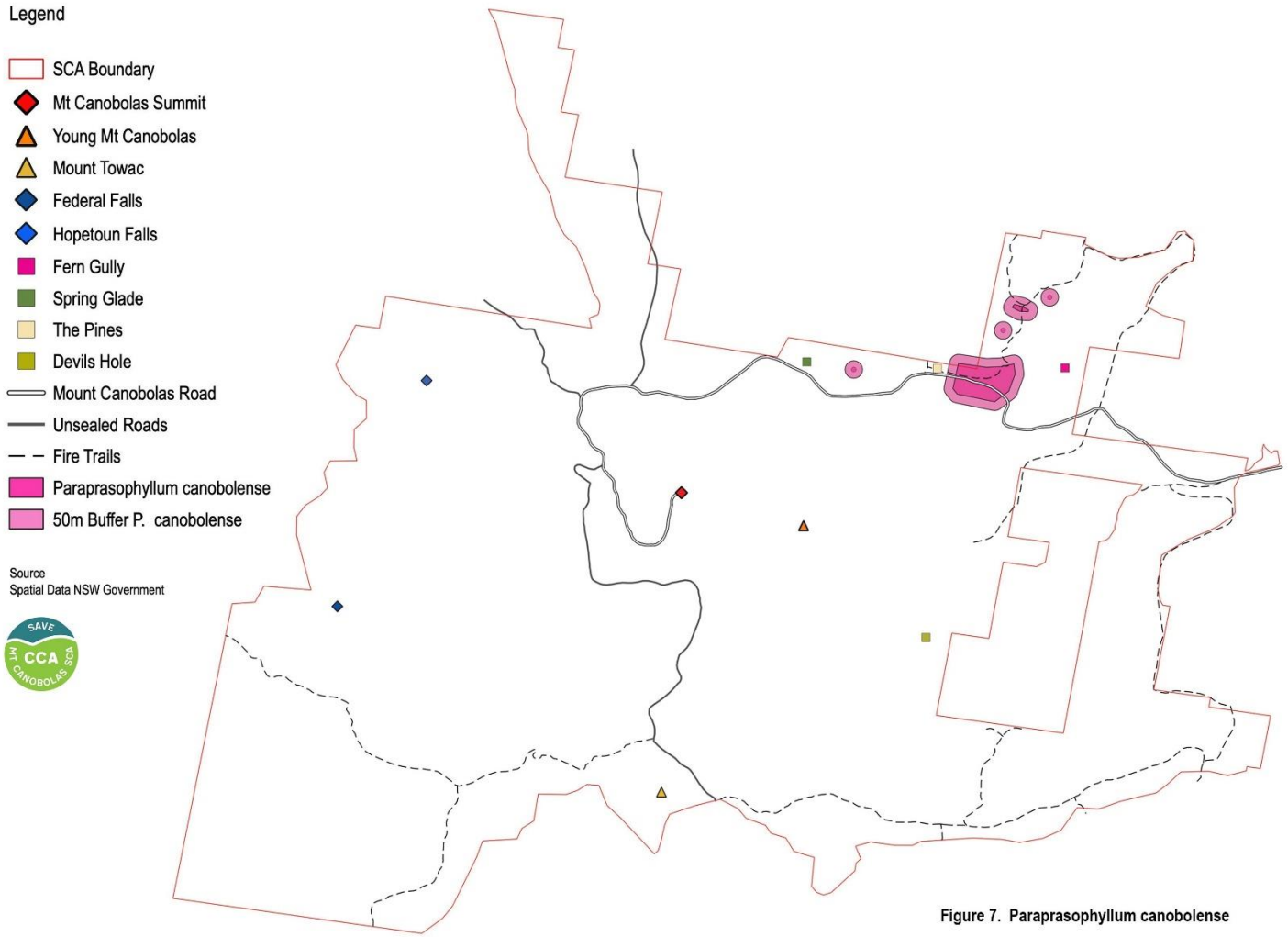

Figure 7. Paraprasophyllum canobolense

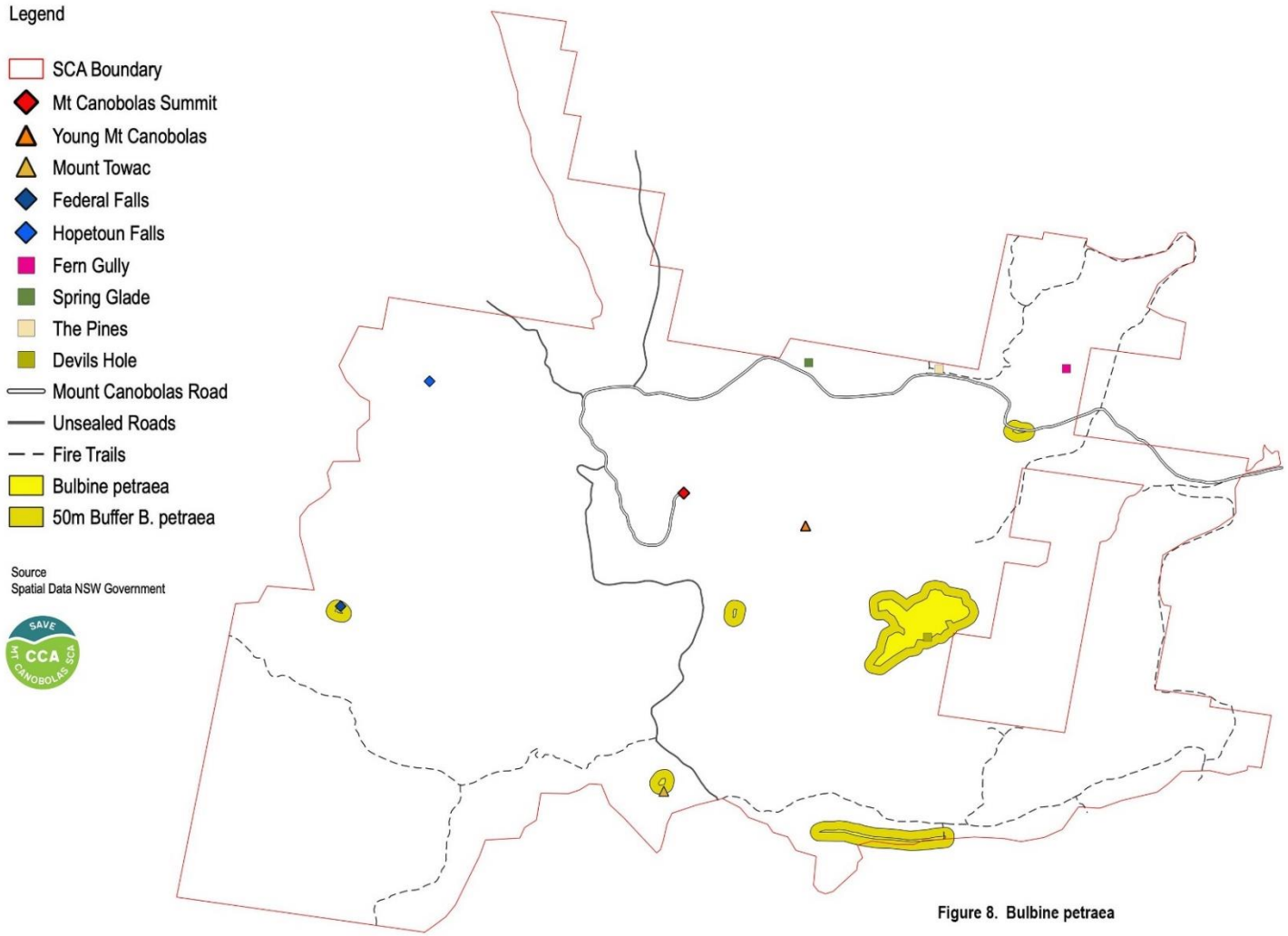

Figure 8. Bulbine petraea

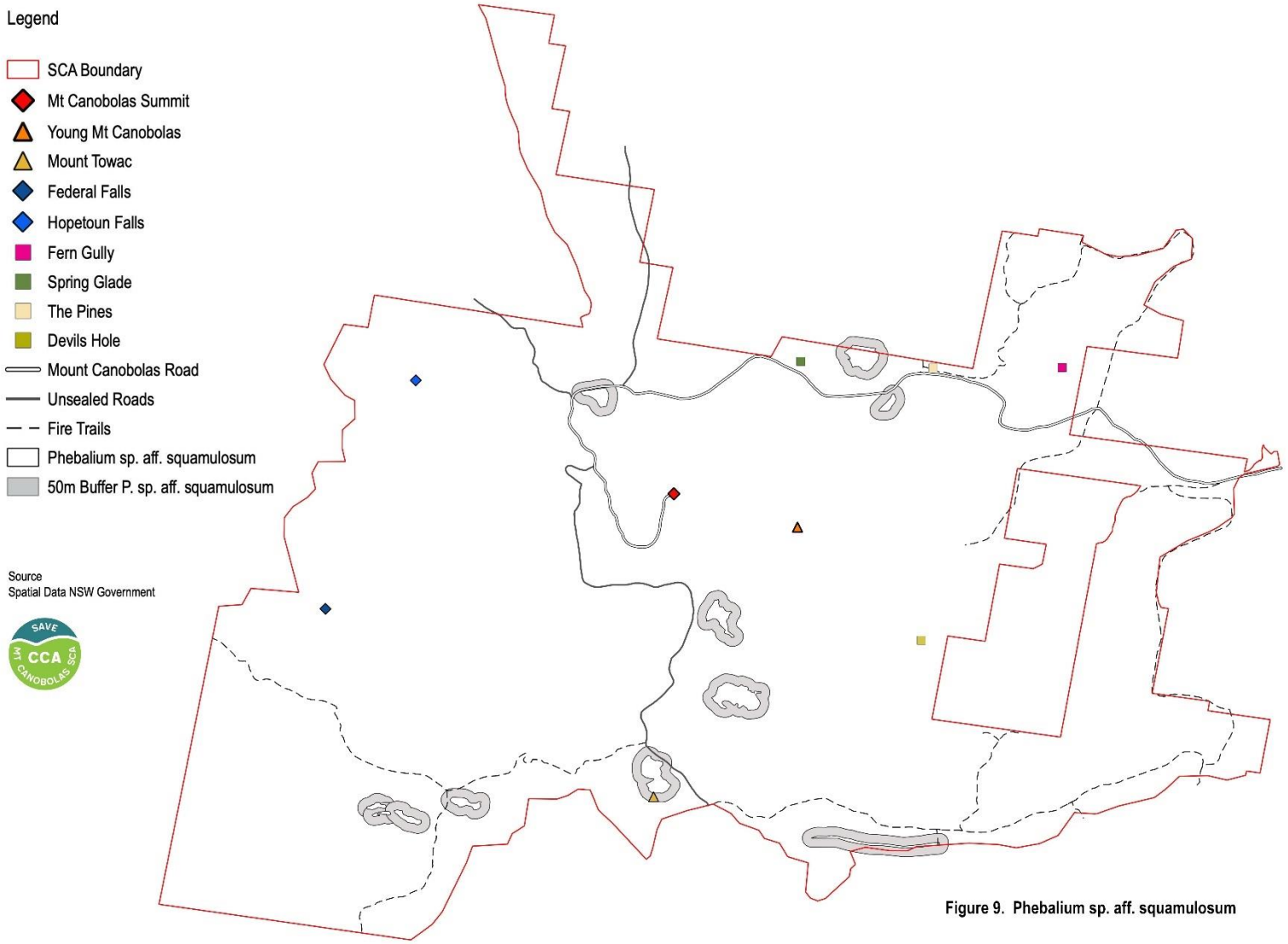

Figure 9. Phebalium sp. aff. squamulosum

Caladenia boweri

This orchid was described as new to science in 2019 (Jones 2019). It is highly distinctive, with no close relatives. It is only known from the SCA, having been seen once, in 1988. It has been nominated for listing as Critically Endangered under the BC and EPBC Acts. If this species is still extant, there is a risk that mountain bike track construction could eliminate undiscovered occurrences and habitat. Its location is not being disclosed in this report, but should be protected from mountain bike tracks with a minimum 50 m buffer. The location of the 1988 plant will be disclosed only to parties with a need to know for conservation purposes.

Caladenia fitzgeraldii

Mt Canobolas is a stronghold for Fitzgerald's Spider Orchid, which is rare throughout its range on the Western Central Tablelands of NSW between Lithgow, Taralga, Orange, Mudgee and Clandulla. The population on Mt Canobolas has declined since the 1980s with local extinctions of two sub-populations within the larger metapopulation, which is a significant local occurrence of this rare species. The current known distribution of *C. fitzgeraldii* in the SCA is shown on Figure 6 with 50 m buffering around individual plants. Figure 6 also shows areas of habitat that formerly supported this species. Like most orchids, individual plants do not flower every year. Consequently, single surveys prior to developments will fail to detect many individuals which could subsequently succumb to disturbance. This species is highly susceptible to loss of individuals and sub-populations as a result of mountain bike track construction and operation.

Paraprasophyllum canobolense

The Canobolas Leek Orchid was described in 2019 as a new species known only from the Mt Canobolas SCA. It is a fire responder with peak flowering occurring in the season after a summer wildfire. Plants of the Canobolas Leek Orchid may lie dormant as a mycorrhizal association in the soil for decades waiting for a wildfire to trigger growth and flowering. Surveys of known habitats of this species in the spring following the February 2018 wildfire revealed a total of 87 flowering individuals. Three additional plants flowered in 2019 making a total known population of 90 plants. This species has been nominated for listing as Endangered under the BC and EPBC Acts.

The dormancy mechanism and the fire dependency of flowering in this species makes individual plants impossible to detect in most years. Consequently, there is a high risk that individuals would be lost to developments because current survey protocols would not guarantee the detection of most of the population. The currently known distribution of the Canobolas Leek Orchid is shown on Figure 7, with a 50 m buffer around the extremities of its known habitat. Exclusion of developments from this habitat zone is essential to avoid inadvertent loss of individuals.

Bulbine petraea (ms)

Plants on Mt Canobolas, currently known as part of the distribution of the Rock Lily, *Bulbine glauca*, have been identified as a new species by botanists at the University of New England, who have given it the manuscript name, *Bulbine petraea* (ms). This species is known only from the Mt Canobolas Volcanic Complex and is rare in the SCA and surrounds. Systematic surveys are yet to be undertaken to ascertain its distribution and population size, however occurrences are small and scattered on rock outcrops. Figure 8 gives its known distribution within the SCA, but this almost certainly underestimates its occurrences. Its limited geographic range and small population size mean that it would qualify for listing as threatened under the BC and EPBC Acts. Protection of this species depends on preventing disturbance to plant communities on rock plates, rock outcrops and rocky creek lines.

OTHER LIKELY ENDEMIC SPECIES

Ongoing studies of the flora of Mt Canobolas SCA have uncovered five other potential new endemic species in the SCA. Two, *Asterolasia* sp. aff. *rupestris* and *Phebalium* sp. aff. *squamulosum*, have been recognised as distinctive for several decades. The *Asterolasia* is restricted to one known location in the SCA and is likely to be critically endangered. Its location is being withheld to minimise the risks of damage and illegal collection. The *Phebalium* is more widespread in and around the SCA within the Mt Canobolas Volcanic Complex. Although locally common, it is restricted to heathland areas on shallow soils, especially rock plates and rock outcrops. Given its limited geographic range it is considered likely to qualify for listing as Vulnerable. Most populations of the *Phebalium* in the SCA are shown in Figure 9, although it is likely to occur at other sites with suitable habitat.

Three other taxa in the SCA are currently under study as potential endemic species, an Urn Heath, *Melichrus* sp. aff. *urceolatus*, and two orchids, a Hyacinth Orchid, *Dipodium* sp. aff. *atropurpureum*, and a Moth Orchid, *Diuris* sp. aff. *chryseopsis*. All are rare in the SCA and if eventually described as new species would likely qualify for listing as threatened. The distribution of the *Melichrus* is poorly known and no map can be provided. The two orchids are known only from a single population each. Details are withheld for conservation reasons. All three taxa are of conservation significance and would require targeted surveys in an environmental assessment of any mountain bike track proposal.

ORCHID HOTSPOTS

Mt Canobolas SCA supports populations of many native forbs that have disappeared from most of the surrounding landscape owing to clearing, cultivation, pasture improvement, grazing, horticulture, forestry and infrastructure development. The SCA is the last refuge in the Orange district for montane and sub-alpine herbs that are now rare, and in some cases, endangered. The high diversity and numbers of these herbs indicate the vegetation over large parts of the SCA remains in close to pristine condition.

Included among the native herbs is a surprisingly high number of native orchid species which are often clustered together in areas referred to as orchid ‘hotspots’ (Bower 2019, 2020). These areas represent the highest groundcover diversity in the SCA and should have a high priority for protection. Areas of high native orchid diversity are now quite rare in the surrounding landscape and confined entirely to less disturbed areas of remnant native bushland and places like some cemeteries that have not been grazed. Known orchid hotspots in the Mt Canobolas SCA are shown on Figure 10. Mountain bike track development should not occur in these areas owing to their significant biodiversity value.

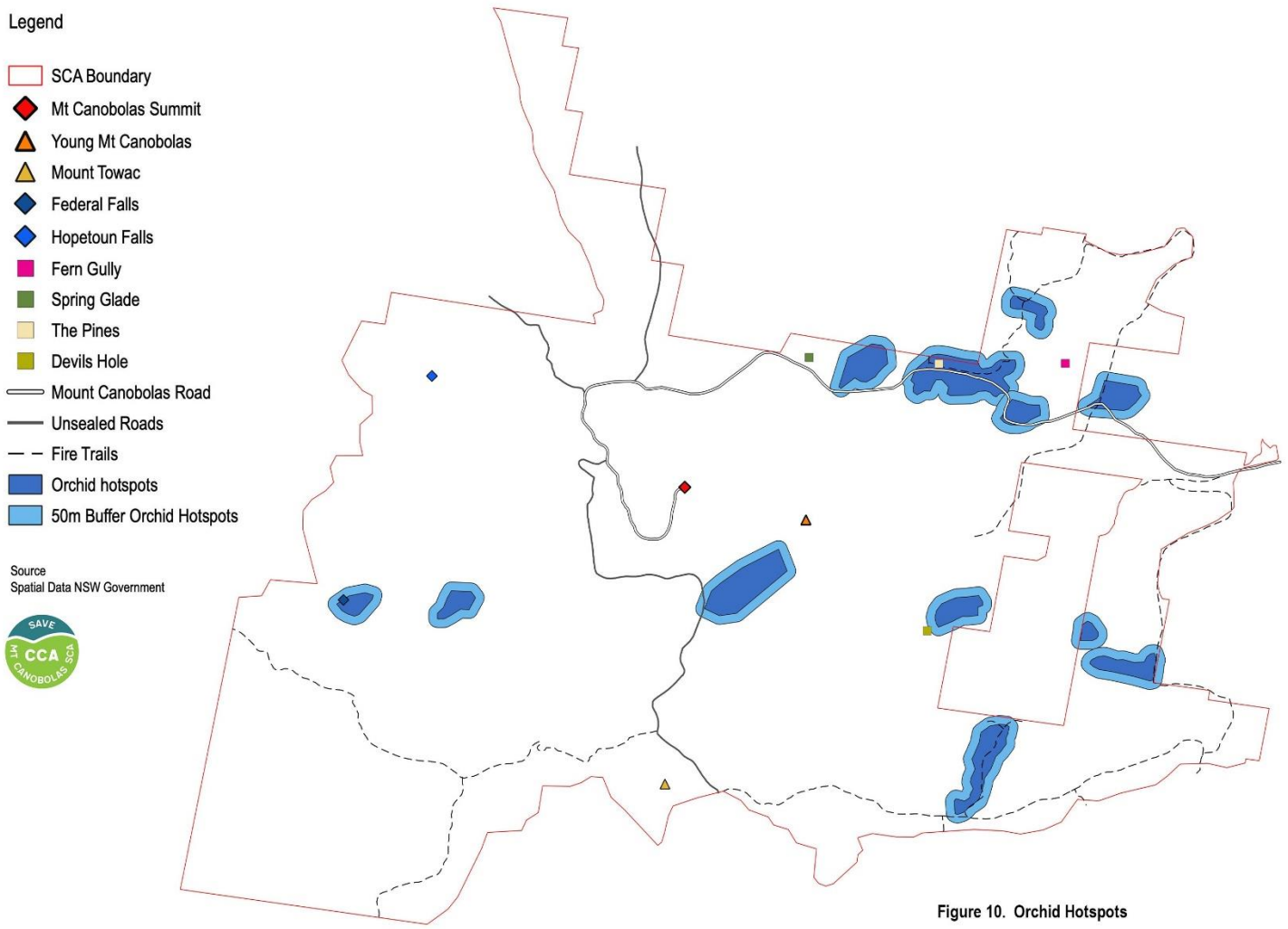

Figure 10. Orchid Hotspots

DISCUSSION OF FLORA

Although study of the flora of Mt Canobolas is in its infancy, knowledge of the unique floristic value of the Mount Canobolas Volcanic Complex (MCVC) has begun to emerge recently. We now have sufficient understanding to recognise that the unique elements in its flora (Medd and Bower 2019) warrant its nomination as an Area of Outstanding Biodiversity Value (Medd and Bower 2018).

The uniqueness of the MCVC derives from its geological history as an intraplate volcano active some 12 to 11 million years ago. When eruptions ceased, the summit of Mt Canobolas is likely to have been 2000 m higher than at present with a lava field extending up to 80 km in all directions. It would have been a very impressive and much more massive volcanic inselberg than it is today. The isolation of Mt Canobolas from the higher altitude areas of the Great Dividing Range to the east, coupled with the ebbing and flowing of montane and sub-alpine flora across the landscape through successive ice ages and warmings, provided a unique environment for the evolution of a distinctive suite of montane and sub-alpine flora (Medd and Bower 2019).

It can be expected that among the 200 or more species with disjunct populations isolated on Mt Canobolas (Medd and Bower 2019) that more endemic species unique to the mountain will be discovered. Accordingly, the SCA is a scientific treasure house of genetic diversity which should be protected for the value of its biodiversity above all else. There are very few, if any, places that have as much biodiversity value in a relatively small area as Mt Canobolas SCA. It would be tragic if unrecognised species were pushed towards extinction, even before they are discovered, by unsympathetic development of the most important nature conservation reserve in the region.

LICHENS

The story of lichens on Mt Canobolas is similar to that of the flora and suggests a parallel evolutionary history. To date, no overall study of the lichen communities on Mt Canobolas has been undertaken. Rather, the limited known information resides in papers describing new endemic species on the mountain and in databases recording the species collected by lichenologists and deposited in herbaria.

There is no information available on the distribution and abundance of any lichen species on Mt Canobolas SCA owing to a lack of systematic survey. Searches of databases and the scientific literature has revealed over 90 species of lichens in the SCA, four of which, *Gyalideopsis halocarpa*, *Sarcogyne sekikaica*, *Megalaria montana* and *Xanthoparmelia metastrigosa* are endemic (Medd and Bower 2019). Given the very restricted distribution of these species, it is considered likely they would qualify as threatened under the BC Act, if they were to be nominated.

The Mt Canobolas SCA hosts the only lichen community in Australia to be listed as threatened (Figure 11):

- *Mt Canobolas Xanthoparmelia Lichen Community Endangered Ecological Community* (Scientific Committee 2001).

The assemblage consists of *Cladia fuliginosa, X. canobolasensis, X. digitiformis, X. metaclystoides, X. metastrigosa, X. multipartita, X. neorimalis* and *X. sulcifera.* It occurs mainly above 1,100 m altitude on rock faces and soil, and is unique to the MCVC. *X. metastrigosa* is endemic to Mt Canobolas SCA and *X. canobolasensis* is known only from Mt Canobolas SCA and one locality in Tasmania while *X. sulcifera* and *C. fuliginosa* are each known from a limited number of other localities within NSW.

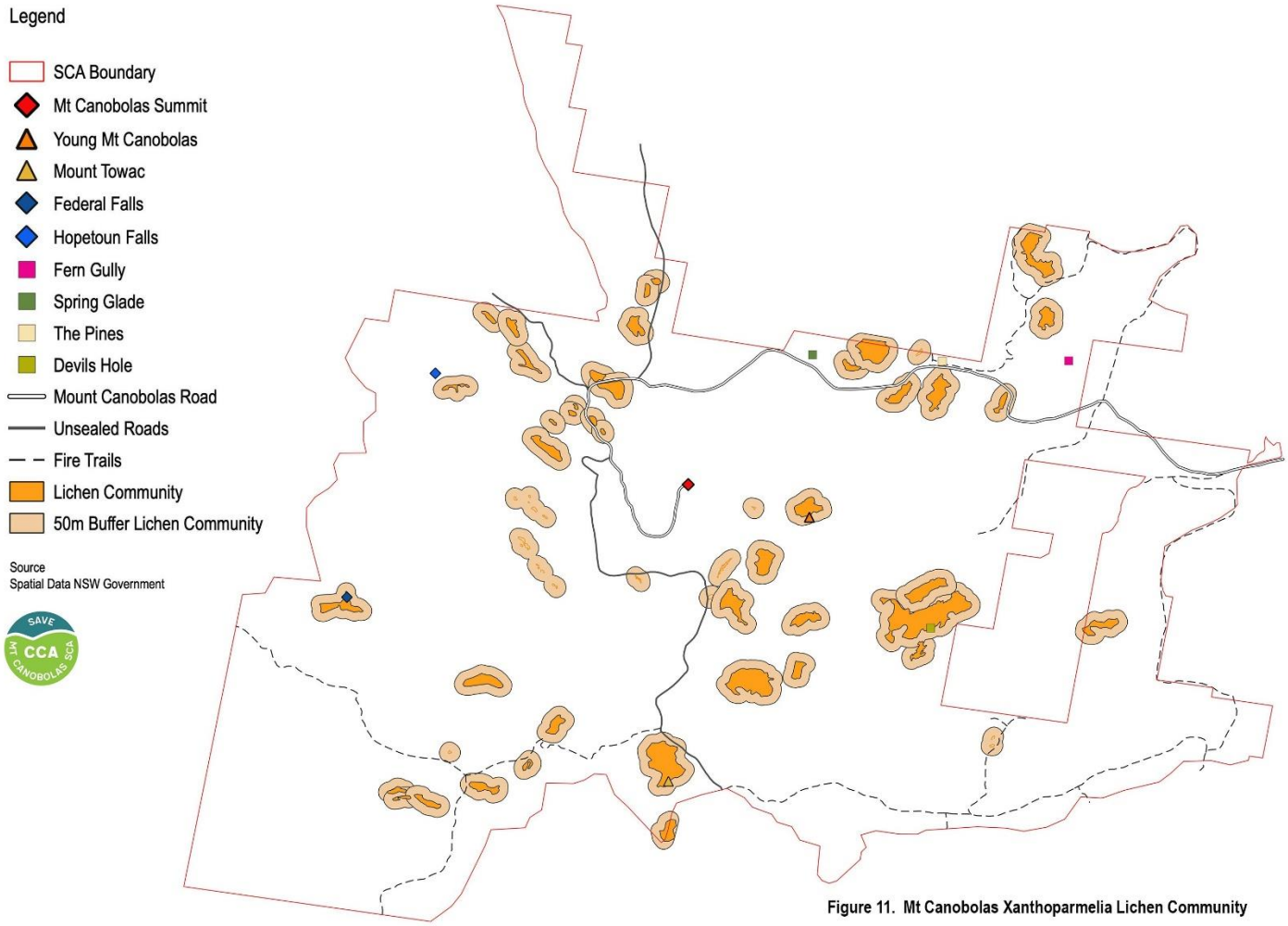

Figure 11. Mt Canobolas Xanthoparmelia Lichen Community

Table 4. Threatened Native Fauna Recorded in the Mt Canobolas SCA

	Family Name	Scientific Name	Common Name	Conservation Status	
				BC Act[1]	EPBC Act[2]
Mammals	Emballonuridae	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail Bat	V	-
	Miniopteridae	*Miniopterus orianae oceanensis*	Eastern Bent-wing Bat	V	-
	Petauridae	*Petaurus australis*	Yellow-bellied Glider	V	-
	Petauridae	*Petauroides volans*	Greater Glider	-	V
	Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat	V	V
	Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	-
Birds	Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V	-
	Artamidae	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V	-
	Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V	-
	Petroicidae	*Petroica boodang*	Scarlet Robin	V	-
	Petroicidae	*Petroica phoenicea*	Flame Robin	V	-
	Psittacidae	*Neophema pulchella*	Turquoise Parrot	V	-
	Strigidae	*Ninox strenua*	Powerful Owl	V	-

[1]Threatened Species listed under the *Biodiversity Conservation Act 2016.*
[2]Threatened Species listed under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999.*

The Xanthoparmelia Lichen Community is particularly prominent on rock plates, rock outcrops and surface rock in the SCA, but also includes two exclusively soil dwelling species, *X. sulcifera* and *C. fuliginosa*, that likely occupy bare soil patches on rock plates and their edges (DPIE 2020d). This unique community is threatened by mountain bike and foot traffic on rock plates and rock gardens.

FAUNA

Threatened Species

Six native mammals recorded in the SCA, including four microbat species and two gliders are listed as Vulnerable under the BC Act and/or the EPBC Act (Table 4) (Medd and Bower 2019). The most important habitat component for the threatened fauna species is hollow-bearing trees, which are abundant in the SCA and critical for the survival of much of its bird, bat and arboreal mammal fauna. Fauna species typically range over the entire SCA which should be considered as habitat for all recorded threatened fauna. Accordingly, disturbance to habitat by mountain bike tracks and the disruption caused by mountain biking activity would impact negatively on threatened fauna.

Endemic Fauna Species

One fauna species is confirmed as endemic in the SCA, the Mt Canobolas Velvet Worm, *Cephalofovea pavimenta*, a species that dates from the age of dinosaurs. It inhabits rotting logs and is known to occur in forested areas where *E. canobolensis* and *E. dalrympleana* logs are distributed, so it is considered likely to occur over much of the reserve. Because observation of the species involves destructive methods, no systematic survey is possible and observations have been restricted to necessarily limited targeted searches. No distribution map is practical for this species, other than to identify most areas within the whole of the SCA. It is paramount that logs of any timber species remain undisturbed within the SCA to protect this unique species. *C. pavimenta* is considered likely to qualify for listing as threatened under the BC Act.

A yellow planarian worm, *Fletchamia* near *sugdeni* is under investigation as another endemic invertebrate species (Medd and Bower 2019). It is expected that systematic survey of invertebrates would likely considerably expand the known biodiversity of the SCA and reveal more endemic species.

SERIOUS AND IRREVERSIBLE IMPACTS (SAII)

Seven entities in the SCA have been identified as susceptible to Serious and Irreversible Impacts (SAII) by the Biodiversity Conservation Division of the Department of Planning Industry and Environment (DPIE 2020b) (Table 5).

Table 5. Species and Ecological Communities in the SCA Designated as Subject to SAII by DPIE

Threatened Entity	Common Name	Conservation Status	SAII Principle
Werriwa Tablelands Cool Temperate Grassy Woodland in the South Eastern Highlands and South East Corner Bioregions	Werriwa Tablelands Grassy Woodland	Critically Endangered	1, 2
Monaro Tableland Cool Temperate Grassy Woodland in the South Eastern Highlands Bioregion	Monaro Tableland Grassy Woodland	Critically Endangered	1, 2
Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions	Tableland Basalt Forest	Endangered	1, 2
Mt Canobolas Xanthoparmelia Lichen Community	*Xanthoparmelia Lichen Community*	Endangered	3
Eucalyptus canobolensis	Silver-leaf Candlebark	Vulnerable	3
Prostanthera gilesii	Giles' Mintbush	Critically Endangered	2, 3, 4
Miniopteris orianae oceanensis	Large bent-winged Bat	Endangered	4

Further, two recently described orchid species, *Caladenia boweri* and *Paraprasophyllum canobolense*, four lichen species and a Velvet Worm endemic to the SCA also meet the criteria for SAII (Table 6). Up to six putative undescribed endemic species would also meet the criteria (Table 6). All thirteen taxa in Table 6 are considered likely to meet the criteria for listing as threatened species, if they were nominated. Two of the orchids, *C. boweri* and *P. canobolense* have been nominated for listing and are currently being evaluated by the NSW Threatened Species Scientific Committee.

Table 6. Endemic Species considered Highly Likely to be Subject to SAII in the SCA

Endemic Entity	Common Name	SAII Principle
Described species		
Cephalofovea pavimenta	Mt Canobolas Velvet Worm	2, 3
Caladenia boweri	Pink Spider Orchid	1, 2, 3
Paraprasophyllum canobolense	Canobolas Leek Orchid	2, 3, 4
Gyalideopsis halocarpa	A Lichen	4
Megalaria montana	A Lichen	4

Endemic Entity	Common Name	SAII Principle
Sarcogyne sekikaika	A Lichen	4
Xanthoparmelia metastrigosa	A Lichen	4
Undescribed taxa		
Asterolasia sp. aff. *rupestris*	Canobolas Starbush	2, 3, 4
Bulbine petraea (ms)	Rock Bulbine Lily	2, 3, 4
Dipodium sp. aff. *atropurpureum*	Canobolas Hyacinth-orchid	2, 3, 4
Diuris sp. aff. *chryseopsis*	Canobolas Moth Orchid	2, 3, 4
Melichrus sp. aff. *urceolatus*	An Urn Heath	2, 3
Phebalium sp. aff. *squamulosum*	A Phebalium	2, 3, 4

The implications of SAII for Environmental Assessments depend on the assessment pathway for the project. In this case the proponent is Orange City Council (OCC) who is essentially acting as a developer seeking approval for a development in a State Conservation Area. If the determining authority is the National Parks and Wildlife Service (NPWS) the determination would be made under Part 5 of the *Environmental Planning and Assessment Act 1979*. Unless OCC opts into the Biodiversity Offsets Scheme (BOS) for the project (section 7.8(3) of the BC Act), the assessment of SAII entities would be solely by Five Part Tests of Significance (section 7.3 of the BC Act) as for other threatened species that are not considered to be SAII.

If, however, the project is assessed under the BOS using the Biodiversity Assessment Method (BAM) the applicant is obliged to determine which species and communities on the project area meet the SAII criteria using the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE, 2020b). Under section 10.2.1.3 of the BAM the entities in Table 5 above must be considered as SAII in the Environmental Assessment. In addition, under section 10.2.1.4 of the BAM the thirteen entities in Table 6, which are also considered to meet the criteria for SAII, must also be identified as potential SAII and considered in the Biodiversity Development Assessment Report (DPIE 2020b).

The first requirement in dealing with SAII in a development proposal is to avoid to the maximum extent possible direct and indirect impacts on them (sections 10.2.2.1 and 10.2.3.1 of the BAM [DPIE 2020c]). In the case of the mountain biking proposal this means directing all tracks and associated infrastructure away from areas supporting the SAII entities and their habitats. The distributions of SAII and their habitats are given in the figures in this report. The conservation importance of these entities is such that no development should be allowed in the areas mapped for each entity.

AREAS OF EXCEPTIONAL CONSERVATION SIGNIFICANCE IN THE SCA

The above data and mapping show clearly that significant biodiversity occurs throughout the Mt Canobolas SCA. There are no areas of the SCA without significant biodiversity. Consequently, any large scale development within the SCA is highly likely to have adverse impacts on multiple sensitive areas and entities.

The most common and widespread threatened entity in the SCA is the Silver-leaf Candlebark, *Eucalyptus canobolensis*, which is present through almost all of the reserve. Similarly, the Endangered and Critically Endangered Ecological Communities are also very widely distributed and, like the Silver-leaf Candlebark, would be unavoidably impacted by any network of mountain biking tracks established within the reserve.

Rare, threatened and endemic species in the SCA are often more localised to areas of suitable habitat. The main known locations of these critical habitat areas are given in Figures 3 to 11. Figure 12 overlays these habitat areas on each other, showing that many parts of the SCA support multiple significant flora species and communities.

Areas of very high biodiversity significance in the SCA include (Figure 13):

- All rock plates, rock outcrops and rock gardens.
- Areas identified as Orchid Hotspots
- Seven areas that support populations of multiple significant entities in close proximity and/or overlapping with each other, including:
    1. The whole Nature Trail area from Walls Lookout to the saddle between Young Man Canobolas and Mt Canobolas.
    2. An L-shaped area from Spring Glade on both sides of the Mt Canobolas Road to east of Orange View Lookout and north to the northern boundary of the SCA.
    3. Federal Falls.
    4. The Devils Hole.
    5. The Indigo Firetrail.
    6. Mt Towac and the heathland/rock plate areas to its west.
    7. South end of Pine Ridge Firetrail to the rock outcrops on the east side of the inholding.

Development in the above areas, shown in Figure 13, should be prohibited. The values of each of these areas are outlined below. However, it should also be recognised that;

A. the remainder of the SCA has high biodiversity value (Figures 12 and 13) and should only be considered for development if no alternatives exist in the Orange district, and
B. some remote parts of the SCA have not been adequately surveyed for biodiversity and likely contain as yet undiscovered highly sensitive areas.

Rock plates, rock outcrops and rock gardens

Rocky areas in the Mt Canobolas SCA host the unique endemic Mt Canobolas Xanthoparmelia Lichen Community, including four species of lichens endemic to the mountain. The full extent of these areas has not been mapped in Figures 11 and 12. For example, several key sites for this community occur on the summit, including the type location of some of the lichen species endemic to Mt Canobolas. Other areas supporting this community occur throughout the SCA. GHD (2015) recommended complete avoidance of areas hosting this community and this conclusion is endorsed here.

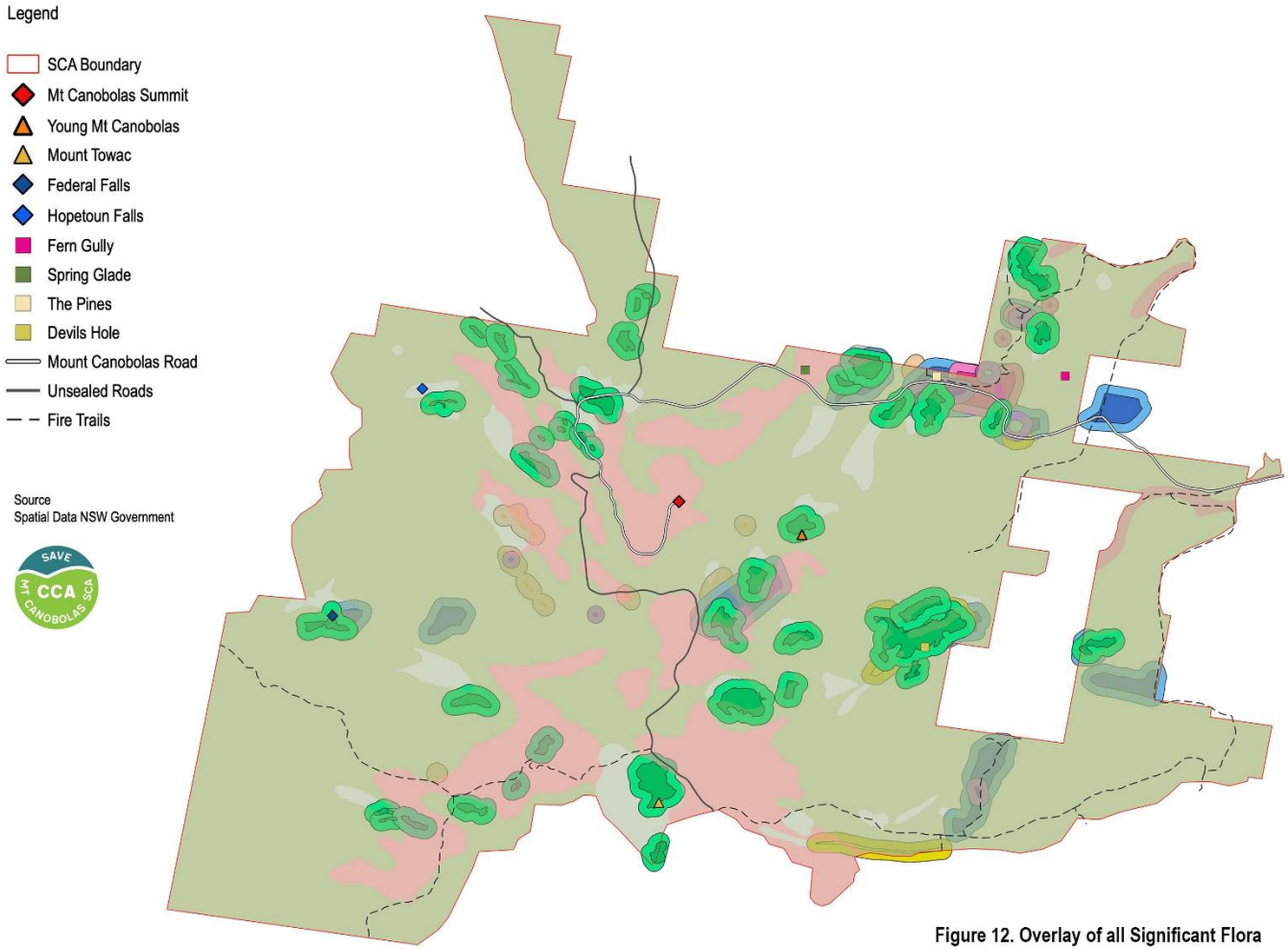

Figure 12. Overlay of all Significant Flora

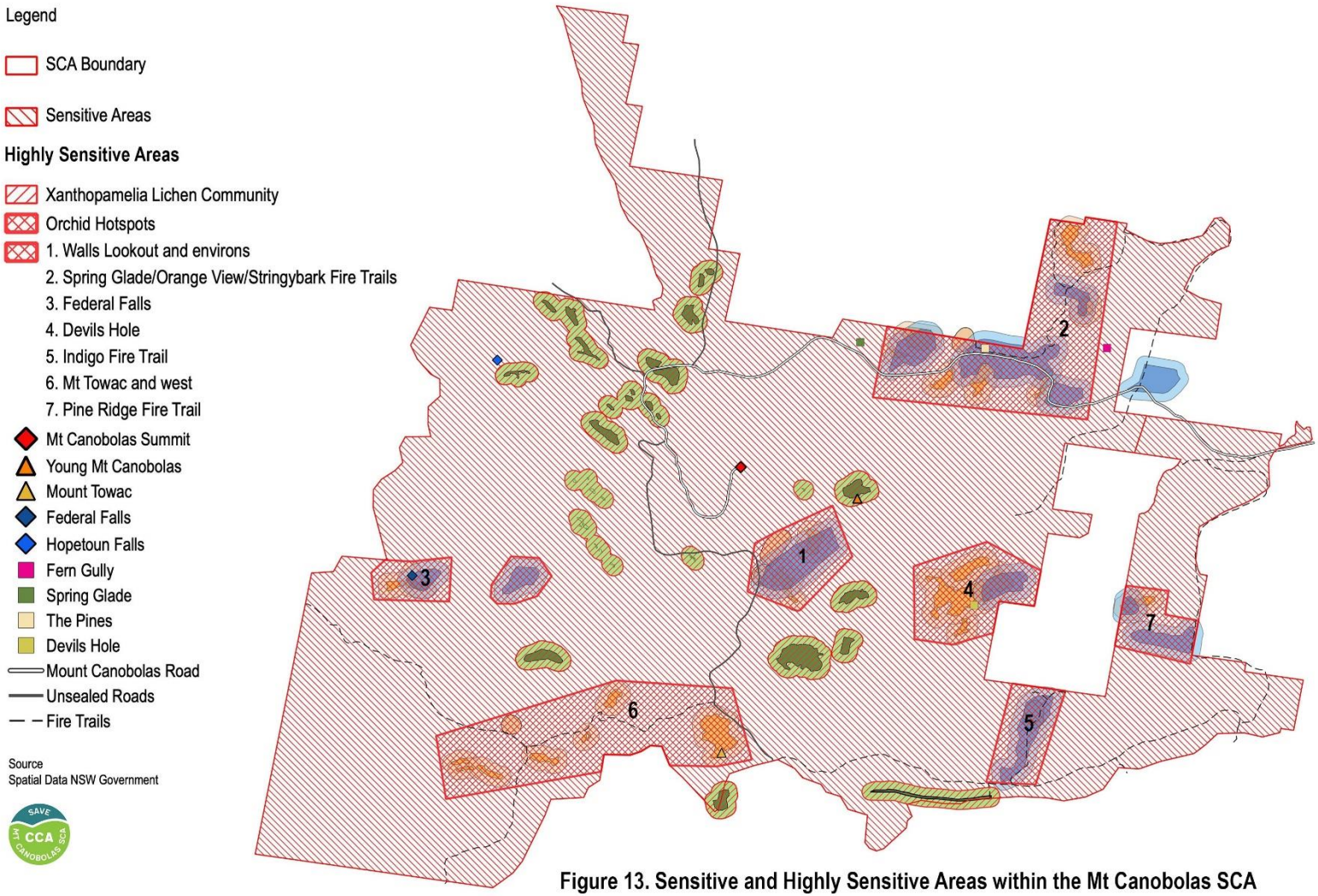

Figure 13. Sensitive and Highly Sensitive Areas within the Mt Canobolas SCA

Rock plates and rock outcrops also provide habitat in shallow soils for the Mt Canobolas heaths, recognised as unique by Hunter (2002). These fragile areas are highly susceptible to damage by mountain bike traffic causing soil erosion and loss of heath substrate. *Phebalium* sp. aff. *squamulosum*, considered by experts to be an undescribed species unique to the MCVC, is a characteristic component of the Mt Canobolas heaths and dependent on the persistence of shallow soils on rock outcrops and rock plates for its survival. Given the scattered and widespread areas of rocky habitat on Mt Canobolas, it is imperative that it be protected from development.

Orchid Hotspots

Orchid hotspots occur widely in the Mt Canobolas SCA (Figure 10) and represent not only unusually high numbers of species and individuals in concentrated areas, but usually also signify habitats that are in close to pristine condition. Such areas also tend to support a wide range of other terrestrial herbs and are among the most diverse patches of habitat in the SCA.

Significant Localities with Multiple Endemic and Threatened Species

1. The Walls Lookout to the Young Man Canobolas saddle

This area supports multiple significant entities including:

- Two important and extensive rock plate areas
- One of the best examples of the Tableland Basalt Forest EEC on the mountain containing old growth trees with a diverse fern gully
- Prime habitat of the endemic Mt Canobolas Velvet Worm
- An area of high orchid diversity
- Populations of *Bulbine petraea, Melichrus* sp. aff. *urceolatus* and *Phebalium* sp. aff. *squamulosum*
- Important habitat of Mt Canobolas heathland.

2. Spring Glade / Orange View Lookout / Stringybark Firetrail

This is one of the most botanically rich areas in the SCA. It is particularly notable for the high diversity of groundcover species, including many forbs that formed part of the diet of the indigenous owners of Mt Canobolas. This area is one of the most important in the SCA for protection of threatened and rare flora. It includes:

- Eight rock plate areas supporting the Xanthoparmelia lichen community and Mt Canobolas heath, including *Phebalium* sp.aff. *squamulosum*.
- The most important orchid hotspot in the SCA, including all populations of the endemic Canobolas Leek Orchid, *Paraprasophyllum canobolense*, the only known site of the endemic Pink Spider Orchid, *Caladenia boweri*, occurrences of the rare Fitzgerald's Spider Orchid, *Caladenia fitzgeraldii* and the only known occurrences on Mt Canobolas of a Golden Moth Orchid, *Diuris* sp. aff. *chryseopsis*, that is considered to be a potential new species endemic to the SCA.
- Part of the Tableland Basalt Forest EEC.
- A population of the Mt Canobolas Rock Lily, *Bulbine petraea* (ms).

3. Federal Falls

Upstream of the crest of Federal Falls, Federal Falls Creek passes through an area of incised open rock that is habitat for the Mt Canobolas Xanthoparmelia Lichen Community, Mt Canobolas heath, native orchids and a significant population of the Mt Canobolas Rock Lily, *Bulbine petraea* (ms).

4. The Devils Hole

Devils Hole is deep in the valley of Towac Creek which rises east of the summit of Mt Canobolas and south east of Mt Towac exiting the SCA near the Mt Canobolas Road entrance. It is an impressive rock platform with columnar basalt outcrops supporting a diverse flora including:

- Mt Canobolas Xanthoparmelia Lichen Community.
- A high diversity of native orchids, including species not found elsewhere in the SCA.
- The largest populations of the Mt Canobolas Rock Lily, *Bulbine petraea* (ms) in the SCA.
- Diverse examples of Mt Canobolas heathland.

5. The Indigo Firetrail

The Indigo Firetrail descends a ridge from The Glider Firetrail to The Crater, the inholding within the SCA. It includes:

- The whole ridge crest for the length of the Indigo Firetrail is an orchid hotspot supporting large populations of multiple species. The most important is the largest population of Fitzgerald's Spider Orchid, *Caladenia fitzgeraldii* in the SCA.
- This area also has the largest known population of *Melichrus* sp. aff. *urceolatus*, which recent research indicates is an undescribed species restricted to the SCA, and possibly Mt Kaputar.
- There is also a substantial rock outcrop with the Xanthoparmelia Lichen Community.
- Tableland Basalt Forest EEC.

6. Mt Towac and the heathland/rock plate areas to its west

Mt Towac is an isolated steep trachyte dome in the south of the SCA with substantial areas of rock outcrop and shallow soils. It supports:

- The Mt Canobolas Xanthoparmelia Lichen Community.
- Important large areas of Mt Canobolas heath.
- Significant populations of the endemic *Phebalium* sp. aff. *squamulosum*.
- Populations of the Mt Canobolas Rock Lily, *Bulbine petraea* (ms).
- Werriwa Tablelands Grassy Woodland CEEC.

7. South end of Pine Ridge Firetrail

A west trending spur off the southern end of the Pine Ridge Firetrail supports a pristine example of grassy montane woodland (Tableland Basalt Forest EEC) with a very diverse herb-rich understorey, including a number of grassy woodland orchid species that are uncommon in the SCA. Adjacent to this spur is an area of dissected rock outcrop supporting Mt Canobolas heath, the Xanthoparmelia Lichen Community and a high diversity of orchid species.

Other areas

It is important to note that not all parts of the SCA have been adequately surveyed and that it is likely other important populations, hotspots and individual occurrences of important biodiversity remain to be discovered. For example, the whole of the south-western Gum Ridge sector of the SCA has not been fully explored because of restricted access and rugged terrain. There are old growth forest trees in this area that have diameters exceeding 2 m, so are several hundred years of age.

While normal environmental assessment procedures would identify the more conspicuous species, there are multiple cryptic species, including orchids and the Mount Canobolas Velvet Worm, for which many individuals within a population are likely to escape detection. It should also be noted that a number of very rare entities, whose locations in the SCA are known, have not been mapped in this report in order to protect their locations from harm by collectors and curious sightseers.

DISCUSSION

Biodiversity Conservation in the Mt Canobolas SCA

The unusually high biodiversity value of the Mt Canobolas SCA is demonstrated by four outstanding characteristics:

1. The SCA meets the criteria as an Area of Outstanding Biodiversity Value.
2. It has an unusually high number of endemic species (11+) for such a small reserve (1,672 ha), two of which are listed as threatened so far.
3. It has a unique threatened endemic lichen community.
4. It has a large number of communities and species (20) meeting the criteria for Serious and Irreversible Impacts.

Area of Outstanding Biodiversity Value (AOBV)

Correspondence from the NSW Department of Planning Industry and Environment has intimated the AOBV nomination is proceeding towards community consultation, once the guideline package is finalised. As a consequence, it is incumbent on the proponent's consultants to assess the impacts of proposed developments in the SCA as if it were an AOBV. This means that under the BC Act the development cannot be assessed by a Review of Environmental Factors, but must be assessed under the Biodiversity Offsets Scheme using the Biodiversity Assessment Method (BAM) and a Biodiversity Development Assessment Report (BDAR). Accordingly, any harm caused to the SCA must be offset by an area of equivalent habitat that is preserved and maintained in perpetuity. This being the case, it makes no sense to harm one area and attempt to offset it with a similar area elsewhere. It would be simpler and more logical not to destroy the important area of habitat in the first place. Avoidance of harm should always be the first option for environmental protection.

Endemic Species

There are five described endemic species (four flora and one fauna) in the SCA and a further six undescribed flora taxa that are considered by experts to be endemic to the SCA (Tables 2 and 3). Two of these have been listed as threatened and two have been nominated for listing. All eleven species are highly likely to meet the criteria for listing as threatened. The existence of these endemic taxa, and the high likelihood that future work will reveal others, highlights the importance of the Mount Canobolas Volcanic Complex as an island of montane and sub-alpine habitat within which species have

evolved in isolation (Medd and Bower 2019). The survival of these taxa depends on the protection of their habitats from development. All of these taxa have very low areas of occupancy and most have very low population sizes. Consequently, any loss of habitat pushes them towards extinction.

Because of their rarity and confinement within the SCA, it is not possible to offset losses to their populations by protecting habitats elsewhere. There is no alternative but to protect the remaining populations of these species from further losses of individuals and habitat. With the possible exception of the Silver-leaf Candlebark, which is widespread within the SCA and some areas in the near surrounds, no development should occur in any areas where species endemic to Mt Canobolas occur, some of which are shown on Figures 5 and 7-9.

Mt Canobolas Xanthoparmelia Lichen Community

Mt Canobolas SCA and some surrounding areas of State Forest support the unique threatened Mt Canobolas Xanthoparmelia Lichen Community. The community contains four species of lichen endemic to the MCVC. Elements of this community are limited to rock outcrops, exposed rock plates and areas of loose surface rock, which are scattered widely within the SCA (Figure 11). GHD (2015) recognised the importance of developments avoiding this community. As with other unique biodiversity within the SCA, this community must be totally protected from development owing to its low area of occupancy and vulnerability to disturbance. There is no opportunity to offset damage to this community through reservation of areas outside the SCA.

Serious and Irreversible Impacts (SAII)

A total of 20 ecological communities, described endemic species and undescribed endemic taxa in the SCA meet the criteria for assessment as SAII.

It testifies to the importance of the SCA for biodiversity protection that its small area of 1,672 ha supports 20 entities that are considered at high risk of extinction from development (Tables 5 and 6). Crucially, these entities, which include all the forest and woodland vegetation in the SCA (Figure 3) and the Silver-leaf Candlebark (Figure 5), occupy the entire SCA, essentially making the whole reserve subject to SAII.

SAII entities are only allowed to be disturbed if a rigorous assessment determines that the adverse '*impact is outweighed by the social and economic benefits the development will deliver to the State*' (DPIE 2020b). It is highly doubtful that the benefits of a mountain biking complex within the Mt Canobolas SCA rise to State significance and justify harming these entities. The most prudent approach, using the Precautionary Principle, to conserving SAII entities is the avoidance of all harm, i.e. in the case of the Mt Canobolas SCA, there should be no mountain bike track development anywhere within the SCA.

Offsetting

The above considerations clearly demonstrate that, for multiple reasons, the OCC mountain biking proposal within the Mt Canobolas SCA should not be approved. However, if the proposal were to be declared a State Significant Development, any disturbance to the SCA would require offsetting under the BC Act.

A major impediment to offsetting is that the uniqueness of the biodiversity within the Mt Canobolas SCA means that no equivalent area of vegetation is available to use as an offset. Consequently, any loss of biodiversity from the SCA is a permanent loss and would go against the principle adopted by

the NSW Government that there should be no net loss of biodiversity from New South Wales. Essentially, the biodiversity on Mt Canobolas is irreplaceable and should not be reduced any further than it already has been.

Nevertheless, a complex set of offsetting rules established under the *Biodiversity Conservation Regulation 2017* would allow the OCC proposal to go ahead with offsetting, if it were a State Significant Development, despite the Serious and Irreversible Impacts that would occur (DPIE 2020b). There are two applicable mechanisms for offsetting biodiversity losses on Mt Canobolas (DPIE (2020b):

1. Funding the purchase and management in perpetuity of an offset area containing equivalent vegetation and species, or buying uncommitted 'credits' from the owner of an independent Stewardship Site with equivalent vegetation and species, or
2. making a payment to the Biodiversity Conservation Fund calculated using the offset payments calculator.

The first option is not available to OCC, since suitable equivalent or sufficiently similar vegetation for offsetting does not occur on private land within the Orange subregion of the South Eastern Highlands Bioregion, and is unlikely to be available in the adjoining subregions. The only alternative available to Council would be making a payment into the Biodiversity Conservation Fund. The magnitude of this payment would likely be very high. The high monetary value that would be placed on the vegetation and threatened species of Mt Canobolas indicates that disturbance to the SCA should be avoided. That is, it would be far more prudent use of ratepayer and/or government funds to build the proposed mountain biking complex in already disturbed sites, such as State Forests or on already cleared land.

CONCLUSION

There is no comparable reserve in the Central West, and likely very few of similar size, if any, beyond the Central West, that support such an array of unique biodiversity. It is beyond question that the Mt Canobolas SCA is the most important nature conservation reserve in the region and must be protected from inappropriate development of any kind, including mountain bike development, such as proposed by OCC. In terms of potential harm to unique biodiversity there is no worse place in the region for the establishment of a mountain biking park.

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