



# Conservation Advice for *Prasophyllum petilum* (Tarengo Leek Orchid)

In effect under the *Environment Protection and Biodiversity Conservation Act 1999* from 29 September 2021.

This document provides a foundation for conservation action and further planning.



Tarengo Leek Orchid © Tobias Hayashi (2021)

## Conservation status

*Prasophyllum petilum* (Tarengo Leek Orchid) is listed in the Endangered category of the threatened species list under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act) effective from 16 July 2000. The species is eligible for listing because prior to the EPBC Act, it was listed as Endangered under the *Endangered Species Protection Act 1992* (Cwlth).

The main factors that make the species eligible for listing in the Endangered category are the species' restricted fragmented distribution and the stochastic risk associated with extreme fluctuations in the number of mature individuals.

Species can be listed as threatened also under state and territory legislation. For information on the current listing status of this species under relevant state or territory legislation, see the [Species Profile and Threat Database](#).

## Species information

### Taxonomy

This species is conventionally accepted as *Prasophyllum petilum* D.L.Jones & R.J. Bates (1991). The NSW Herbarium considers *Prasophyllum petilum* and *Prasophyllum* sp. Wybong (C. Phelps ORG5269) to be synonyms (i.e., the same species).

### Description

The Tarengo Leek Orchid is a slender tuberous terrestrial orchid (DECCW 2010). Each plant grows to 35 cm tall and produces a solitary, tubular, fleshy, dull green leaf with a purple base. The plant is highly inconspicuous when growing among tall grasses or when occurring in small numbers (OEH 2020). Tarengo Leek Orchid plants can be distinguished from the more common *Microtis* spp. (Onion Orchids), which also grow in its habitat, by the pinkish-purple base of its leaf.

The Tarengo Leek Orchid persists as a tuber during late summer and autumn, sprouting in May before flowering (DECCW 2010). The flower-spike emerges in mid-spring to early summer from a hole near the base of the leaf. The spike, reaching to 12 cm tall, has about 20 sweetly fragrant flowers with pointed petals. The flowers are usually a pale whitish-green but can be pink or pale purple (OEH 2020). After flowering, small obovoid seed capsules may form.

The Tarengo Leek Orchid has affinities with the more widespread species *P. campestre* (Sandplain Leek Orchid). It is distinguished from the Sandplain Leek Orchid by its generally slenderer habit (with fewer, smaller flowers in a narrow spike) and its short, almost vestigial hamulus on the pollinarium. The Sandplain Leek Orchid has a more westerly distribution than the Tarengo Leek Orchid, ranging widely on the inland plains of New South Wales (Bates 1994).

### Distribution

Known populations of the Tarengo Leek Orchid occur in the grassy woodlands and grasslands of the southern tablelands and western slopes of New South Wales (NSW) and the Australian Capital Territory (ACT). Given the level of environmental fragmentation and degradation across this region since European settlement, it is assumed that the Tarengo Leek Orchid was once more common and widespread than it is today (DECCW 2010). Today, natural populations are only known from a total of five sites in NSW and one population in the ACT (ACT Government 2019, DECCW 2010). In NSW, subpopulations are found near Boorowa (Tarengo Travelling Stock Reserve (TSR)), Queanbeyan area (Captains Flat Cemetery), Ilford (Bathurst NSW) and Delegate (Steves TSR) (OEH 2020). This species has also been recorded at Bowning Cemetery where it was experimentally introduced, though it is not known whether this subpopulation has persisted (OEH 2020).

There is some doubt as to whether the Delegate and Captains Flat populations are the Tarengo Leek Orchid (Jones 2020). The Tarengo Leek Orchid is part of a complex of species which are difficult to identify, and a dedicated population genomics project is required to delimit species in the group (A. Wheeler 2021. pers. comm 5 May).

In the ACT, the Tarengo Leek Orchid is only known to occur at the Hall Cemetery, on the northern border of the ACT, where the species was first identified in 1991 (DECCW 2010). The orchid is named after the TSR near Boorowa NSW which contains the largest population.

One of the difficulties of estimating the mature population size of the Tarengo Leek Orchid is that only flowering individuals are readily identifiable. Population size estimates are based primarily on flowering individuals, so that non-flowering individuals, including those persisting as dormant tubers, are not counted. The true population size may therefore be larger than the estimates of flowering individuals (DECCW 2010). Plants retreat into subterranean tubers after fruiting, so are not visible above-ground outside of growing periods. Nevertheless, estimates of population size at each site are provided in Table 1 (DECCW 2010).

The largest known NSW population is the Tarengo TSR, where there have been estimates of a population size greater than 2000 plants. A count carried out in 2020 found 2314 individuals (DPIE 2021). Monitoring over the period 1995–2000 at the Tarengo TSR site showed that the mean number of flowering stems has varied from two to 29 per m<sup>2</sup>, with a maximum of up to 100 stems per m<sup>2</sup> (DECCW 2010). Other populations have relatively few individuals.

The Hall Cemetery in the ACT contains the second largest population of the Tarengo Leek Orchid (Wilson et al. 2016). Monitoring of the Hall Cemetery population over the last 25 years shows that the population has fluctuated substantially from year to year. The population varies between nil to 96 plants, however between 20 and 60 flowering plants are usually counted each year. Fluctuations were particularly evident during earlier surveys. Fluctuations in the size of the population have often been attributed to climatic variation, although no specific causal factors have been identified (Wilson et al 2016). Statistical analysis of the Hall Cemetery population indicates that it increased until the early 2000s, from which point it has remained relatively stable (Wilson et al. 2016, ACT Government 2019).

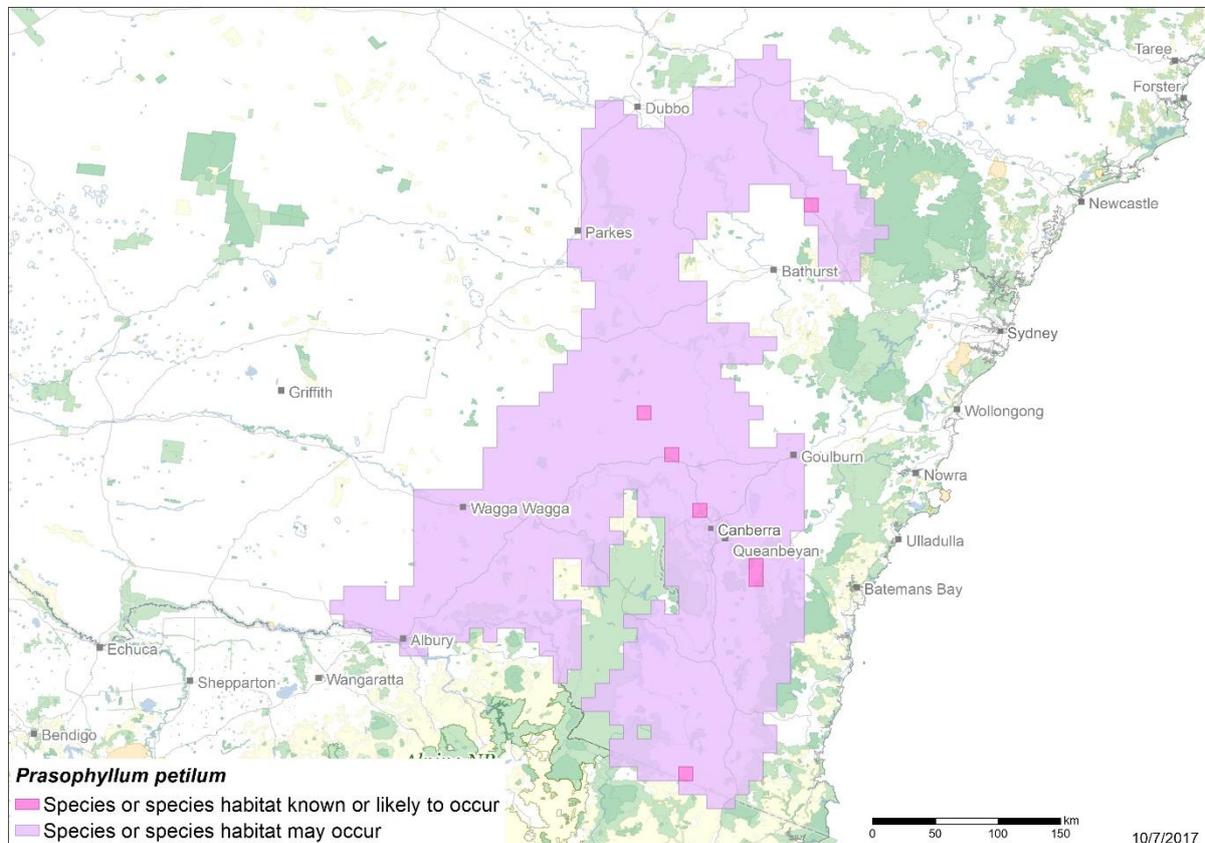
The population trend of the Tarengo Leek Orchid is not known for any sites except for the Hall Cemetery site (Fitzgerald 2017; Table 1).

**Table 1 Estimated population sizes of Tarengo Leek Orchid**

Site	Year	Total number of plants	Area	Population trend
Tarengo Travelling Stock Route (TSR) (Boorowa NSW)	2020	2314 individuals	2.5 ha	Unknown
Hall Cemetery (ACT)	2009	26. The number of flowering plants has fluctuated from year to years within a range of 0 to 96. A count between 20 and 60 flowering plants is usually counted each year.	0.5 ha	Stable
Captains Flat Cemetery (NSW)	2020	No plants (leaf or flower)	0.5ha	Unknown
Illford Cemetery (Bathurst NSW)	2009	6	20 m <sup>2</sup>	Unknown

Site	Year	Total number of plants	Area	Population trend
Steves TSR (Delegate NSW)	2020	2101	1 ha	Unknown

**Map 1 Modelled distribution of Tarengo Leek Orchid**



**Source:** Species distribution data [Species of National Environmental Significance](#) database, base map Geoscience Australia

**Caveat:** The information presented in this map has been provided by a range of groups and agencies. While every effort has been made to ensure accuracy and completeness, no guarantee is given, nor responsibility taken by the Commonwealth for errors or omissions, and the Commonwealth does not accept responsibility in respect of any information or advice given in relation to, or as a consequence of, anything containing herein.

**Species distribution mapping:** The species distribution mapping categories are indicative only and aim to capture (a) the specific habitat type or geographic feature that represents to recent observed locations of the species (known to occur) or preferred habitat occurring in close proximity to these locations (likely to occur); and (b) the broad environmental envelope or geographic region that encompasses all areas that could provide habitat for the species (may occur). These presence categories are created using an extensive database of species observations records, national and regional-scale environmental data, environmental modelling techniques and documented scientific research.

### Cultural and community significance

Although little is known of the cultural significance of Tarengo Leek Orchid, other orchid species are culturally significant plants for Indigenous peoples, with their tubers used as a food source (Australian National Botanic Gardens 2007). Their contemporary significance requires investigation.

### Relevant biology and ecology

Given the small population size and relatively recent identification of the Tarengo Leek Orchid (in 1991), its biology and ecology are poorly understood (Wilson et al. 2016). Further studies

are required of its life history, flowering, pollination and germination biology, the environmental factors influencing growth and the genetic variability between populations (DECCW 2010, Wilson et al. 2016, ACT Government 2019).

### *Habitat ecology*

The Tarengo Leek Orchid grows among native and (to a lesser extent) exotic grasses in grassy woodland or natural grassland occurring on fertile soils at flat or gently sloping sites. Soils are usually loams, clay loams or sandy clays. Winters are cold, and summers mild to warm. Rainfall is relatively evenly distributed, with a slight decrease in autumn and winter (DECCW 2010, OEH 2020).

Species of the genus *Prasophyllum* are known to prefer moister soils in depressions and swamps (Jones 1988). This characteristic appears to apply to the Tarengo Leek Orchid, given it occurs in relatively moist areas at all sites.

The water table is high at the Hall site (ACT Government 1997) and standing free water is known to occur in the orchid habitat for up to 24 hours after storms. Tarengo TSR is not visibly wet for much of the year however standing water is evident in the area where the orchid occurs following rain. Co-occurring species such as *Pentapogon quadrifidus*, *Schoenus apogon* (Sorghum), *Drosera peltata* (Pale Sundew), *Sebaea ovata* and *Haloragis heterophylla* (Rough Raspwort) confirm that the site is poorly drained (DECCW 2010). Table 2 provides a summary of the habitat ecology at each known Tarengo Leek Orchid site (DECCW 2010, OEH 2020).

The three cemetery sites (Hall, Captains Flat and Ilford) are dominated by *Eucalyptus pauciflora* (Snow Gum) and *E. aggregata* (Black Gum) at Captains Flat and *E. blakelyi* (Blakely's Red Gum) and *E. melliodora* (Yellow Box) at Hall and Ilford. Both Tarengo TSR and Steves TSR are natural grasslands (DECCW 2010).

**Table 2 Summary of the habitat ecology at each of the known Tarengo Leek Orchid sites.**

Site	Median annual rainfall (mm)	Ecological community	Dominant overstorey species	Dominant understorey species
Tarengo TSR (Boorowa NSW)	593	Natural Temperate Grassland Endangered Ecological Community Natural Temperate Grassland of the Southern Tablelands (EPBC Act)	"Corcoran's Plains", an area of c. 200 ha regarded by local farmers and historians to have been a largely treeless grassy plain at the time of European settlement	<i>Austrodanthonia</i> spp. (Wallaby Grasses) compared to that within the denser stands of <i>Themeda australis</i> (Kangaroo Grass) Dense swards of Kangaroo Grass ( <i>Themeda</i> sp.). The orchid occurs only occasionally within these areas, favouring instead more open swards of <i>Bothriochloa macra</i> (Red-leg Grass), <i>Pentapogon quadrifidus</i> and <i>Austrodanthonia</i> spp. (Wallaby Grass) that dominate the south-western section of the TSR.
Hall Cemetery (ACT)	616	Partially cleared area within Yellow Box - Blakely's Red Gum Grassy Woodland (ACT) and White Box- Yellow Box - Blakely's Red Gum Grassy Woodland Endangered Ecological	<i>E. blakelyi</i> (Red Gum) and <i>E. melliodora</i> (Yellow Box)	<i>Themeda</i> sp. (Kangaroo Grass) <i>Austrodanthonia</i> sp. and <i>Rytidosperma</i> spp. (Wallaby grasses) with a high diversity of forbs. There are localised dominant patches of the exotic grasses Yorkshire Fog ( <i>Holcus lanatus</i> ) and Sweet Vernal-grass ( <i>Anthoxanthum odoratum</i> ), which fluctuate annually.

Site	Median annual rainfall (mm)	Ecological community	Dominant overstorey species	Dominant understorey species
		Community (Commonwealth)		
Captains Flat Cemetery (NSW)	688	Yellow Box - Blakely's Red Gum Grassy Woodland	<i>Eucalyptus pauciflora</i> (Snow Gum) and <i>E. aggregata</i> (Black Gum). Eucalypt regrowth is particularly strong in parts of the Captains Flat Cemetery. A patchy shrub layer consists of <i>Hakea microcarpa</i> (Small-fruited Hakea), <i>Acacia dealbata</i> (Silver Wattle) and <i>Leptospermum brevipes</i> (Slender Tea-tree)	<i>Poa sieberiana</i> (Grey Tussock-Grass) and <i>Themeda</i> sp. (Kangaroo Grass). Tarengo Leek Orchid occurs mainly in patches of Wild Sorghum ( <i>Schoenus apogon</i> ) that occur amongst the <i>Poa</i> sp.
Ilford Cemetery (Bathurst NSW)	723	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland Endangered Ecological Community (Commonwealth and NSW listed)	<i>E. blakelyi</i> (Red Gum) and <i>E. melliodora</i> (Yellow Box) and some <i>Eucalyptus camphora</i> (Swamp Gum) where the plants occur has been excluded from regular mowing for several decades. Apparently, the area became too boggy to mow easily and now there is significant regeneration of trees.	Dense cover (>90%) of <i>Themeda</i> sp. (Kangaroo Grass) and Wild Sorghum ( <i>Schoenus apogon</i> )
Steves TSR (Delegate NSW)	649	Natural Temperate Grassland Endangered Ecological Community Natural Temperate Grassland of the Southern Tablelands. (EPBC Act)	Natural grassland in a frost hollow, surrounded by Snow Gum on the slopes above.	?

### Reproductive ecology

The flowering time for this species varies along its north to south distribution, seemingly in association with temperature variation. Northern populations around Muswellbrook and Ilford tend to flower in September, with the more central Boorowa and Hall populations flowering in October, and the southernmost and highest altitude Captains Flat and Delegate populations flowering in December (OEH 2020).

The inflorescence develops folded in half inside the leaf before flowering. It is uncommon for individual plants to flower in consecutive years and this may contribute to the fluctuations observed in population sizes (Wilson et al. 2016). For individuals, the minimum interval between flowering events is generally less than five years. However, periods of up to 16 years between flowering have been recorded at the Hall Cemetery.

Comparable fluctuations between the Hall Cemetery and Tarengo TSR populations indicate that landscape-scale factors – such as climate – may influence flower abundance. Minimum winter temperatures, particularly the number of nights at or below - 4°C, have been correlated with lower numbers of recorded flowering plants at the Hall Cemetery (Wilson et al. 2016). This finding indicates that cold air and frost may damage the leaf and thus prevent flowering (Wilson

et al. 2016). As immature plants are not readily identifiable in grassland, there is uncertainty regarding the time taken prior to initial flowering (OEH 2020, Wilson et al. 2016).

There are no specific studies on the pollination ecology of the Tarengo Leek Orchid, however a generalist thynnine wasp has been identified as an important pollinator for the species (DECCW 2010).

Following pollination, small seed capsules form which usually mature four to six weeks after flowering (in summer). Orchid seeds are dust-like and wind-dispersed. The greatest number of seeds probably fall within metres of parent plants, however dispersal over larger distances is possible (Bower 2002, OEH 2020). The conditions associated with viable seed production are not known and attempts to artificially disperse seed at sites historically occupied by the Tarengo Leek Orchid have been unsuccessful.

Successful germination of the Tarengo Leek Orchid has been carried out at the Mount Annan Botanic Gardens (DPIE 2021).

It is not clear how long plants live, as the maximum period a plant may be dormant is not known. Tuber dormancy of up to five (but more commonly one or two) years has been recorded for the related species, *P. correctum* (Gaping Leek Orchid) (DECCW 2010). Given the plants can survive underground for some time, longevity and rates of mortality are not known (OEH 2020).

Like most orchids, *Prasophyllum* species are generally outcrossers (i.e., pollination occurs between relatively unrelated individuals). Although reproduction is mostly by seed, daughter tubers are also produced (Jones 1988). The species is thought to be highly colonial, with very large numbers present at the Tarengo, Hall and Boorowa sites, however low numbers have been recorded Captains Flat, Ilford and Delegate sites (OEH 2020).

#### *Fire ecology*

Fire is known to cause a range of effects on other species of the *Prasphyllum* genus (Jones 1988). Population observations from the Hall Cemetery where fire has been consistently absent for some time – and is likely to remain so – indicates that the Tarengo Leek Orchid is not dependent on fire, and that fire is not a factor in the observed fluctuations in populations at this site (Wilson et al. 2016).

#### **Habitat critical to the survival**

Due to the species' eligibility for listing (highly restricted range, severe fragmentation, and small population size), all habitat is considered critical to the survival of the species.

This habitat includes the area of occupancy (AOO) of known populations, all areas of the species' historical occurrence and all areas of potential habitat (habitat areas with attributes necessary for the species' persistence) throughout its geographic and ecological range. All known, historical and potential habitat for the Tarengo Leek Orchid may be critical for habitat connectivity, range extension and future translocations.

No Critical Habitat as defined under section 207A of the EPBC Act has been identified as yet or included in the Register of Critical Habitat.

## Important populations

In this section, the word population is used to refer to subpopulation, in keeping with the terminology used in the EPBC Act and state/territory environmental legislation

There is sufficient evidence through the species' eligibility for listing to declare all populations/the national population as important populations of this species, which require protection to support the recovery of the species.

## Threats

The Tarengo Leek Orchid has suffered past loss, degradation, and fragmentation of habitat due to residential, infrastructure and agricultural developments. These threats have the potential to continue, with increasing development pressures exerted on the areas in which the Tarengo Leek Orchid grows.

Current threats to the species' persistence include inappropriate mowing or grazing regimes, especially in spring and summer when above-ground parts are growing, and competition from other plant species competing for space and resources, both native and non-native.

The species is also particularly vulnerable to climate change due to the small number of populations with fragmented localised distributions (DECCW 2010, ACT Government 2019).

**Table 3 Threats impacting Tarengo Leek Orchid**

Threat	Status and severity <sup>a</sup>	Evidence
Climate Change		
Increased temperature and change to precipitation patterns	Status: current Confidence: known Consequence: major Trend: increasing Extent: across the entire range	Climate change is a significant and persistent change in the mean state of the climate and its variability (CSIRO & Bureau of Meteorology 2015). Given the small population sizes at Hall, Captains Flat, Ilford and Delegate. The most likely event to cause extinction is prolonged drought. For example, the Captains Flat population may have declined already in response to the prolonged dry period between 2001–2009, with very dry years in 2002, 2004, 2006 and 2009. Around 40 individuals were recorded in 2002, with only 20 plants in 2009 (and no plants being found in flower) (DECCW 2010). Fluctuations in the number of flowering plants have been similar between the Hall Cemetery and Tarengo TSR sites (DoE 2010), indicating flowering may be influenced by climate rather than site specific environmental factors. Recent analysis indicates flowering is associated with minimum winter temperatures with an increase in the number of frost nights presenting a possible threat to the reproductive output (Wilson et al. 2016).
Habitat loss, disturbance, and modifications		
Cemetery maintenance	Status: historical/current Confidence: known Consequence: moderate Trend: static Extent: across part of its range	Three of the five sites are active cemeteries (Hall, Captains Flat and Ilford). Cemetery management such as the removal of above-ground material due to inappropriate mowing or grazing regimes (especially in spring and summer, when above-ground parts of the plant are present) threatens populations of Tarengo Leek Orchid. Ongoing development of the sites also potentially conflicts with conservation management for the

Threat	Status and severity <sup>a</sup>	Evidence
		<p>Tarengo Leek Orchid. Other practices associated with site management, such as grave establishment, spraying herbicide, mowing, the operation of machinery and inappropriate horticultural planting may also be threats (DECCW 2010).</p> <p>For example, since the population at the Hall Cemetery was identified in 1991, there have been several instances where individuals have been dug up, or damaged by establishment of graves. In 1994, a mowing plan was established to avoid mowing plants while they are above ground. However, there have been further instances of plants being mown or damaged during or before flowering until around 2013. The Hall Cemetery remains an active site with several burials every year. The Hall Cemetery Management Plan (Conservation Research and Canberra Cemeteries 2013) provides recommendations on how to undertake common activities while minimising damage to the Tarengo Leek Orchid population. There are a small number of ongoing sales of burial plots (a few per year), and over 70 pre-sold plots. New burial plots are located away from existing plants, but it is possible that recruits will establish on ground reserved for burials. Recently, the plants have been translocated within the cemetery. However, it is not known whether the translocated plants have survived (DECCW 2010, NSW OEH 2020).</p> <p>However, at Ilford Cemetery it is not likely that future burials in the next 10–20 years will threaten the Tarengo Leek Orchid (DECCW 2010).</p>
Grazing	Status: historical/current Confidence: known Consequence: moderate Trend: static Extent: across part of its range	While it appears that Tarengo Leek Orchid can withstand some grazing (cf. historical grazing at Tarengo TSR), it is likely that there is a critical level of grazing above which its survival would be reduced (DECCW 2010). The population in the TSRs (Boorowa & Delegate) are particularly at risk from cattle grazing. Any loss of individuals due to grazing pressure and any reduction in recruitment due to the grazing of flowering stems, particularly from the Delegate site, is considered detrimental to the species' long-term survival (ACT Government 2019, DECCW 2010). Increased browsing/grazing pressure has been identified as a major threat to a similar species, the Gaping Leek Orchid. Grazing of emerging plants, particularly in the first season after fire, has been shown to significantly reduce flowering (Coates et al. 1999).
Damage by <i>Cacatua galerita</i> (Sulphur Crested Cockatoos)	Status: current Confidence: known Consequence: minor Trend: unknown Extent: across part of its range	For many years, a flock of <i>Cacatua galerita</i> (Sulphur-Crested Cockatoos) have repeatedly visited the Hall Cemetery to feed during spring, primarily on the bulb of the weed species Onion Grass ( <i>Romulea rosea</i> ). They often cause damage to Tarengo Leek Orchid flowering stems and those of other native forb species (eg. <i>Bulbine bulbosa</i> (Bulbine Lily)) by biting through the stems. Areas of orchid habitat are also disturbed by the birds digging in their search for Onion Grass bulbs. The extent of disturbance varies annually. Such damage has the potential to reduce the production of viable seed and could affect the recruitment of new

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Threat	Status and severity <sup>a</sup>	Evidence
		individuals and reduce habitat condition (ACT Government 2019). Damage by Sulphur Crested Cockatoos occurs occasionally at Tarengo but is limited to a few plants (DPIE 2021)
Invasive species		
Competition from other native plant species	Status: current Confidence: known Consequence: moderate Trend: increasing Extent: across the entire range	<p>Competition from native species may threaten Tarengo Leek Orchid populations through shading and/or increased root competition. Competition with other plants may also influence the number of flowering individuals (NSW OEH 2020).</p> <p>At the Captains Flat Cemetery native shrubs, particularly <i>Hakea macrocarpa</i> (Small-fruited Hakea) and <i>Leptospermum brevipes</i> (Slender Tea-tree), have increased in number, spreading into areas where Tarengo Leek Orchid is growing (DECCW 2010). A significant proportion of the <i>Microtis</i> or <i>Prasophyllum</i> leaves found in 2009 were underneath or on the margin of shrubs (DECCW 2010).</p> <p>At Ilford Cemetery, the cover of native grasses is very high, such that there is almost no exposed ground. Small herbaceous species such as the Tarengo Leek Orchid are probably seriously competitively disadvantaged due to the dense native grass cover (DECCW 2010).</p> <p>At Tarengo TSR, Tarengo Leek Orchid is predominately found in a Beardgrass-Oatgrass (<i>Bothriochloa-Danthonia</i>) sward and is uncommon within <i>Themeda</i> sp. (Kangaroo Grass) swards which occur along the southern edge. Three permanent monitoring plots indicate that the <i>Themeda</i> sp. advanced into the Beardgrass-Oatgrass sward from 1995–2002, and thus is a potential threat to the orchid population (NSW OEH 2020). The <i>Themeda</i> has encroached into the <i>Bothriochloa</i> area. A burn was planned for May 2021 to reduce the biomass of native plants and open up the habitat for the Tarengo Leek Orchid (DPIE 2021).</p>
Competition with invasive weeds	Status: current Confidence: suspected Consequence: moderate Trend: unknown Extent: across the entire range	<p>The impacts of exotic weeds on the Tarengo Leek Orchid are not well established, as the abundance of weeds fluctuates with seasonal conditions (DECCW 2010). The introduced grasses Sweet Vernal Grass (<i>Anthoxanthum odoratum</i>) and Yorkshire Fog (<i>Holcus lanatus</i>) are abundant in the Hall and Captains Flat Cemeteries. These grasses have become more prominent at Hall over the last five years (DECCW 2010). Other introduced grasses that occur in the Hall Cemetery include Tall Fescue (<i>Festuca elatior</i>), Soft Brome (<i>Bromus molliformis</i>), Great Brome (<i>Bromus diandrus</i>), Fescue (<i>Vulpia</i> sp.), and Wild Oats (<i>Avena fatua</i>). There has also been encroachment of herbaceous perennial weeds such as St John's Wort (<i>Hypericum perforatum</i>) and Paterson's Curse (<i>Echium plantagineum</i>).</p> <p>Monitoring is required to determine the level of threat to the species (ACT Government 2019).</p> <p>Onion Grass is present in large numbers in some areas of Tarengo TSR that may otherwise be habitat for the orchid. St John's Wort is also present in parts of Tarengo TSR. Control of these weeds through the application of herbicide is carried out</p>

Threat	Status and severity <sup>a</sup>	Evidence
		by the Lachlan Livestock Health and Pest Authorities staff (DECCW 2010).

Status—identify the temporal nature of the threat;

Confidence—identify the extent to which we have confidence about the impact of the threat on the species;

Consequence—identify the severity of the threat;

Trend—identify the extent to which it will continue to operate on the species;

Extent—identify its spatial content in terms of the range of the species.

Each threat has been described in Table 3 in terms of the extent that it is operating on the species. The risk matrix (Table 4) provides a visual depiction of the estimated level of risk being imposed by a threat and supports the prioritisation of subsequent management and conservation actions. In preparing a risk matrix, several factors have been taken into consideration, they are: the life stage they affect; the duration of the impact; and the efficacy of current management regimes, assuming that management will continue to be applied appropriately. The risk matrix and ranking of threats has been developed in consultation with experts and using available literature.

**Table 4 Tarengo Leek Orchid risk matrix**

Likelihood	Consequences				
	Not significant	Minor	Moderate	Major	Catastrophic
<b>Almost certain</b>	Low risk	Moderate risk	Very high risk	Very high risk <b>Increased temperature and change to precipitation patterns</b>	Very high risk
<b>Likely</b>	Low risk	Moderate risk	High risk <b>Cemetery maintenance Competition from other native plant species Competition with invasive weeds</b>	Very high risk	Very high risk
<b>Possible</b>	Low risk	Moderate risk <b>Damage by Sulphur Crested Cockatoos</b>	High risk <b>Grazing</b>	Very high risk	Very high risk
<b>Unlikely</b>	Low risk	Low risk	Moderate risk	High risk	Very high risk
<b>Unknown</b>	Low risk	Low risk	Moderate risk	High risk	Very high risk

Priority actions have then been developed to manage the threat particularly where the risk was deemed to be ‘very high’ or ‘high’. For those threats with an unknown or low risk outcome it may be more appropriate to identify further research or maintain a watching brief.

## Conservation and recovery actions

### Primary conservation objective

By 2030, the population of the Tarengo Leek Orchid will have increased in abundance and viable populations are sustained in habitats where high-risk threats are managed effectively.

### Conservation and management priorities

#### Climate Change

- Use distribution modelling and predictive future modelling to map new future habitat.
- Investigate the effect of future climatic conditions on the frequency and severity of frost nights and subsequent effects on flowering success.
- Identify potential refugia and translocation sites for the Tarengo Leek Orchid under a changing climate.

#### Habitat loss disturbance and modifications

- Prevent further degradation of habitat including cemetery and TSR maintenance activities. This may include but is not limited to:
  - Maintaining the structural complexity of vegetation, including the regeneration and persistence of the existing open woodland/grassland community, Yellow Box - Blakely's Red Gum Grassy Woodland and Natural Temperate Grassland, which may support the Tarengo Leek Orchid.
  - Mark sites of known and potential habitat onto maps (of the farm, shire, region, etc) used for planning (e.g., road works, residential and infrastructure developments, remnant protection, rehabilitation).
  - Ensure protection measures involve site management to conserve the species, including the implementation of actions outlines in management plans such as the Hall Cemetery Management Plan (Jones 1992, ACT Government 2013a, 2013b).
  - Protect populations of the Tarengo Leek Orchid at the Hall and Ilford cemeteries from further burials within the existing cemetery.
  - Avoid incompatible activities such as vehicle movement in habitat areas.

#### Invasive species (including threats from grazing, trampling, predation)

- Reduce and maintain native and exotic weed densities at low levels using site-based weed control. Hand weeding is the only method that is appropriate for weeds among or near the Tarengo Leek Orchid, until there is a proven alternative that is not harmful to the species. Avoid burning and herbicide in Tarengo Leek Orchid habitat areas (e.g., Fusillade TM) until investigations of their impact on the orchid are undertaken (DECCW 2010).
- Implement an appropriate grazing management strategy, particularly for the Tarengo and Delegate TSR populations. It is especially important that grazing is managed during flowering and fruiting. The sections of the TSRs with the Tarengo Leek Orchid should not be stocked from October–February, and preferably not from August until after December.
- Carry out burning or mowing of the habitat in autumn if the density of the grass or shrub layers needs to be reduced. If the site is burned, it should not be burned again for five to ten years.

### **Breeding, seed collection, propagation, and other ex situ recovery action**

- Manage the risk of losing genetic diversity through the following:
  - Continuation of appropriate seed collection and storage in long-term custodial collections.
  - Collection of seeds from all-natural populations.
  - Best practice seed storage guidelines and procedures should be adhered to maximise seed viability and germinability.
  - Develop and maintain ex situ germplasm collections from all populations.
  - Owing to the small size of the Hall population and the difficulties faced in collecting seed from *Prasophyllum* species, there is an ongoing need to add to the seed bank from the Hall Cemetery population.
  - Propagate sufficient individuals to augment extant populations and undertake translocations to supplement populations or establish insurance sites.
  - Determine appropriate translocation sites and procedures.
  - Establish new populations through translocations, adhering to the Guidelines for the Translocation of Threatened Plants in Australia (Commander et al. 2018) and the ACT Conservator Guidelines for the Translocation of Native Flora and Fauna in the ACT (ACT Government 2017).
- Enhance the long-term viability of populations through the management of adjacent Yellow Box-Blakely's Red Gum Grassy Woodland and Natural Temperate Grassland ecological community, to increase the possibility of natural range expansion and connections between subpopulations.

### **Stakeholder engagement/community engagement**

- Liaise with South East Local Land Services (LLS), Queanbeyan Palerang Regional Council (QPRC) and Mid-Western Regional Council Canberra Public Cemeteries Trust to protect the Tarengo Leek Orchid populations at Steves TSR and the Hall, Captains Flat and Ilford Cemeteries. Facilitate the development of a management plan for the site that recognises the environmental significance and management requirements of the orchid.
- Ensure land management is sympathetic to the long-term requirements of the species. This should be achieved through the negotiation of land management agreements and through the implementation of formal measures to protect the species from potentially damaging activities including infrastructure works, recreational activities and the drift of dust and fertilizers from neighbouring areas.
- Erect appropriate signage to inform the public of the cultural and natural heritage significance of sites and provide contact details for further information (DECCW 2010).
- Co-ordinate the implementation of recovery actions through a species and/or ecological community recovery team. Continue the refinement of suitable seed collection methods and methods to translocate greenhouse germinated plants in conjunction with ANBG, Greening Australia and other parties.
- Collaborate with universities, CSIRO, the Australian National Botanic Gardens, and other research institutions as well as Friends of Grasslands and Greening Australia to facilitate and undertake required research and on-ground actions respectively.

- Engage with the community, including Aboriginal communities, to assist with monitoring and other on-ground actions, and to help raise community awareness of conservation issues and the cultural significance of the Tarengo Leek Orchid.

### **Survey and monitoring priorities**

- Undertake annual monitoring of habitat condition/degradation (including impacts from weed invasion, grazing and mowing regimes).
- Undertake annual monitoring of population stability (expansion or decline), pollination activity, seed production, and recruitment.
- Monitor the numbers and approximate projected cover of shrubs within the species' area of occupancy at Captains Flat.
- Monitor the spread and changes in density of Kangaroo Grass at the Tarengo TSR to establish whether it is having a detrimental effect on Tarengo Leek Orchid numbers.
- Monitor Eucalypt regeneration at Hall Cemetery.
- To further understand the potential causes of population size fluctuations, continue to survey habitat areas of Tarengo Leek Orchid, either as part of other survey work or as time and resources permit (DECCW 2010). Specifically, investigation of surrounding vegetation structure and dominance, soil moisture, climatic conditions (such as temperature) and evidence of disturbance (such as cockatoo diggings or mowing) will be required.

### **Information and research priorities**

- Further studies are required to understand the life history of the species, environmental factors influencing growth, flowering, pollination and germination, and genetic variability between populations including:
  - Population genetic structure, levels of genetic diversity, genetic viability of the current seed bank and minimum viable population size.
  - Soil seed bank dynamics.
  - Germination requirements.
  - Recruitment requirements.
  - Reproductive strategies, phenology, and seasonal growth.
  - Pollinator biology and requirements including soil chemistry, moisture, and mycorrhizal fungi associations.
  - Effects of habitat fragmentation and how surrounding vegetation is associated with patterns of flowering.
  - Effect of potential future climate regimes on the frequency and severity of frost nights and subsequent effects on flowering success.
  - Conduct burning and grazing trials to determine whether there was a significant increase in Tarengo Leek Orchid numbers after disturbance.
  - Investigate broad-scale control of widespread weeds such as Sweet Vernal Grass, Fog Grass or Phalaris.

## Links to relevant implementation documents

[ACT Government Native Woodland Conservation Strategy](#)

[National Recovery Plan for \*Prasophyllum petilum\* \(2010\)](#)

[Threat abatement plan for competition and land degradation by rabbits \(2016\)](#)

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