

**Mt Vulcan  
Nickel Laterite Resource**

**BOTANICAL SURVEY AND FAUNA HABITAT ASSESSMENT**

For Proto Resources and Investments

PRO01- November 15 2011



## SUMMARY

Proto Resources and Investments (Proto) is the owner and operator of exploration licence (EL) 17/2006 which contains the Barnes Hill Nickel Laterite resource. The Barnes Hill tenement EL 17/2006 is located approximately 30km north of Launceston and 5km west of Beaconsfield near the Tamar River in northern Tasmania. The richest nickel laterites are in the Barnes Hill and Mt Vulcan areas of the EL. The nickel laterite resource occurs in association with serpentinite.

Exploration is now complete at the Barnes Hill deposit and a DPEMP is currently being considered. Proto Resources now wish to commence exploratory drilling at the Mt Vulcan site. . It is now their intention to begin drilling program in late 2011 to confirm the extent of the resource prior to making any decision regarding a mine. The drilling program is proposed to be based on a grid of 50 m centres. .

A flora and fauna habitat assessment was undertaken over the two resource blocks at Mt Vulcan in October and November 2007. The latest proposal extends the area slightly but also requires reconsideration to ensure it includes all biodiversity values that are protected by Commonwealth and State legislation.

The following vegetation types and threatened flora fauna habitat values were recorded.

### Vegetation

#### Mt Vulcan

*Eucalyptus ovata* shrubby forest (DOV) 4.7 ha; endangered

*Eucalyptus obliqua* dry forest (DOB) 51 ha; not threatened

*Eucalyptus amygdalina* coastal forest (DAC) 83.5 ha; not threatened

*Eucalyptus* damp sclerophyll forest (DSC) 40 ha; not threatened

### Threatened Flora

The following threatened flora species listed on the *Environmental and Biodiversity Conservation Act 1999* and the *Tasmanian Threatened Species Protection Act 1995* were recorded:

*Epacris virgata* (Endangered EPBC vulnerable TSPA) – The following figures are based on measurements before a fire burnt the habitat in 2010. There are very few unburnt plants remaining and the abundance of regeneration is uncertain at this early stage. *E. virgata* is very difficult to observe or distinguish at this stage of succession and so the approach taken is conservative and may be a better estimate of carrying capacity than attempting to assess the immature regeneration. It is ecological protocol to count mature individuals when estimating the size of a population of a plant species.

We estimate that 111 700 (+-38 047) occur at Mt Vulcan extending over 55 ha. These figures are based on measurements before a fire burnt the habitat in 2010. There are very few unburnt plants remaining and the abundance of regeneration is uncertain at this early stage.

Based on the original estimates, the drilling program may disturb up to approximately 16 500 plants and may kill up to 590 plants.

*Tetratheca gunnii* (Critically endangered EPBC endangered TSPA)

No evidence of this plant was found in the earlier survey of during this review.

No known plants will be affected by the drilling program.

*Pimelea curviflora* (rare TSPA)

Found on the southern slopes of Settlers Hills. The site is outside of the proposed drilling program.

**Threatened Fauna Habitat**

The following threatened fauna species listed on the *Environmental and Biodiversity Conservation Act 1999* and the *Tasmanian Threatened Species Protection Act 1995* were recorded or have suitable habitat in the resource blocks:

**Grey Goshawk**

No suitable blackwood or riparian habitat occurs within the drilling area. Potential habitat is marginal and restricted to Andersons Creek and an unnamed class 4 stream outside of the drilling area. All stream side habitat will be buffered by 10 m (class 4) or 20 m (class 2 and 3).

**Masked owl**

No masked owls were observed during call back survey in 2007. Trees with suitable hollows exist in the study area. All trees with large main stem hollows will be avoided during the drilling program.

**Wedge-tailed Eagle**

Although no eagle nests were recorded during survey and none are anticipated to occur. A number of nests are known from the Dazzler Range in suitably protected habitat. As such it is unlikely that eagles would nest in the sub prime habitat of the Mt Vulcan sites. Nevertheless, all old growth trees will be avoided and all trees that are felled will be inspected for nests before felling and retained if nests are found.

**Eastern barred bandicoot**

No significant or direct impact is anticipated on this species. Suitable small grassy areas tend to occur on serpentinite outcrops. However, these are not the target of drilling and are outside of the drilling area.

**Spotted-tailed quoll**

There will be no significant impact on spotted-tailed quoll. The resource blocks do not support good quality den habitat. There are no suitable rocky outcrops, hollow logs are rare and do not make ideal defensible dens.

**Tasmanian devil**

There will be no significant impact on the Tasmanian devil. There are no suitable rocky outcrops, hollow logs are rare and do not make ideal defensible dens.

**Australian grayling and green and gold frog**

Andersons Creek supports potential habitat for the grayling. There are very limited locations of potential green and gold frog habitat at the margins of the drilling area. All standing water and streams will be avoided and drainage into all streams will be protected by 10 m buffers. Andersons creek will be buffered by 20 m if drilling occurs nearby.

**Weeds and *Phytophthora cinnamomi***

Spanish heath, gorse and *Pinus radiata* occur adjacent to two tracks at Mt Vulcan. The *P. radiata* are at the sites of past settlements. The spanish heath should be controlled before any work proceeds.

*Phytophthora cinnamomi* has been isolated from the serpentine soils south of the Mt Vulcan resource block but has not caused an epidemic of disease. Field observations suggest that the saprolite soils may be suppressive to disease in species other than *X. australis*.

A strategy to reduce the risk of introduction and spread of *Phytophthora cinnamomi* has been developed. The strategy is based on standard PC hygiene protocols, exclusion of known and symptomatic infection sites, drilling areas free of PC first and disturbed areas and areas at highest risk of already supporting PC last.

### **Legislative Implications**

#### ***Environmental and Biodiversity Conservation Act 1999.***

The original drilling program was referred to the Commonwealth in 2008 for consideration of potential impact on all MNES. The minister judged that the program could proceed in the manner specified in the approval decision. In light of the very minor changes to the program and major expansion of the extent and abundance of the only species being directly impacted (*Epacris virgata*) in the adjacent reserves no new referral is recommended so long as it is undertaken in the manner specified in the approval decision.

#### ***Tasmanian Threatened Species Protection Act 1995.***

Four threatened flora species listed on this Act were recorded in the study area. A permit will be required to disturb *E. virgata* which is the only one of the four species found to occur in the drilling area.

#### ***Tasmanian Weed Management Act 2002***

Spanish Heath and gorse are Declared weeds. These species must be prevented from spreading to habitats of threatened species and communities.

The eradication of spanish heath and gorse is achievable from the Mt Vulcan resource block.

### **Recommendations**

1. Minimise the potential for impact on threatened flora and fauna habitat values:
  - a. Avoid *Epacris virgata* to the extent possible.
  - b. Avoid old growth trees (trees with hollows).
  - c. Do not enter within 10 m of class 4 streams and 20 m of Andersons Creek.
2. Implement the *Phytophthora cinnamomi* risk management strategy.
3. Eradicate spanish heath and gorse from the Mt Vulcan resource block.
  - a. Determine if the *Pinus radiata* have significant cultural value.
  - b. If not remove the pines from the Mt Vulcan resource block .

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Dr Phil Bell: Manager Threatened Species Section DPIW (masked owl).

Wendy Potts: Botanist, Threatened Species Section - DPIW. (*Tetratheca gunnii* and *Epacris virgata*).

Bill Brown: TSS, DPIW. Eagle nests.

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# 1. INTRODUCTION

## 1.1 BACKGROUND

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A flora and fauna habitat assessment was undertaken over the two resource blocks at Mt Vulcan in October and November 2007. The latest proposal extends the area slightly but also requires reconsideration to ensure it includes all biodiversity values that are protected by Commonwealth and State legislation. The following vegetation types and threatened flora fauna habitat values were recorded.

Three threatened flora species of National Environmental Significance are known to occur in and around the nickel laterite and serpentinite in a patchy mosaic. These are *Tetratheca gunnii*, *Epacris virgata (sensu stricto)* and *Spyridium obcordatum*. These plants are listed on the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC) as critically endangered, endangered and vulnerable respectively.

Given the intensity of the proposed drilling program, being at 50 m centres, an survey of the flora and fauna habitat values fit for this purpose was proposed. In the first instance the aim is to determine the likelihood and extent of any possible impact of the drilling program on the three threatened flora species but all significant flora and fauna values are to be taken account of.

Proto have engaged *North Barker Ecosystem Services* to review the work undertaken in 2007 and update to reflect minor changes to the proposal and to accommodate changes to the Commonwealth and State legislation. This report presents the findings of a survey and habitat assessment covering the Mt Vulcan resource blocks relevant to a 50 m drilling program.

## 1.2 THE STUDY AREA

The site is in the cool temperate climatic zone, with approximately 900 mm of rainfall per annum. The altitude is below 100m ASL.

The geology is varied with the resource blocks being largely on Tertiary gravels and Cambrian volcanics at Mt Vulcan (250 000 BMR).

The exploration lease covers the low foothills of the Dazzler Range west of the Tamar River. The foothills are largely forested and dissected by creek lines. The forests are dry sclerophyll with wet sclerophyll forests along main creek lines. The original survey encompassed the EL and this review updates the extent of the drilling proposal.

The tenure covers Crown and private land. The Crown land is State Forest and Conservation area while the private land is used for agriculture, plantation and gravel quarrying.



**Figure 1 – Location of study area.**

### 1.3 LIMITATIONS

It should be noted that no plant survey can guarantee that all vascular flora will be recorded during a single visit due to the limitations of the sampling technique, seasonal and annual variation in abundance and the possible absence of fertile material for identification. Ephemeral species that may have been overlooked include, for example, summer and winter flowering herbs, notably orchids. Additional species are likely to occur that may be recorded by repeated visits over several years and at different seasons. However, all significant species known to occur in the vicinity of the proposed lease area are addressed in this report.

The estimates of population sizes provided here are based on a sampling strategy for which the power has not been tested. The best estimates refer only to the areas

sampled. Additional plants are likely to be present outside of the sampled areas. For *Tetradlea* and *Spyridium* the probability of overlooking plants within the sampled area is high if they are rare within the area. However, the probability of *T. gunnii* occurring in the drilling area is very low.

## **2. BOTANICAL SURVEY AND FAUNA HABITAT ASSESSMENT**

### **2.1 BACKGROUND RESEARCH**

The following sources were used for biological records from the region:

EPBC Web server.

Natural Values Atlas <sup>1</sup> - all threatened plant and animal records within 5 km of the proposed development.

The Threatened Fauna Manual <sup>2</sup> – threatened species recorded from the relevant map sheet (Tasmap, Tasmania 1: 25 000 series).

Threatened Fauna Advisor- Forest Practices Board

TASVEG v2.0 - vegetation communities.

### **2.2 BOTANICAL SURVEY**

The botanical survey was carried out on October 15-18 and October 31 – Nov 3<sup>rd</sup> 2007 and October 28 2011. The survey periods were timed to coincide with the peak flowering of *Epacris virgata* and *Tetradlea gunnii*.

The survey was based on a 1 ha grid covering the whole study area. Within each hectare the vegetation community was recorded. All vegetation types were sampled and species were recorded from a 20\*20 m plot within each vegetation type to characterise the community. Additional species were added to the list as they were encountered in each hectare of the same community.

A hand held GPS was used to navigate along transects within the 1 ha matrix. In each hectare in which *Epacris virgata* was present the plants were counted in 10 \* 1 m<sup>2</sup> plots. Test samples indicated that individual multi stemmed plants reached a maximum carrying capacity of mature plants in the order of 16 plants per 1 m<sup>2</sup>. On this basis individual mature plants occupy an area of about 25 cm \* 25 cm. Our estimates per 1 m<sup>2</sup> are therefore based on the presence or absence of *E. virgata* in each 25\*25 cm sub plot and assume that any stems within each subplot belong to a single individual. A running mean indicated that the mean density per sample had stabilised in most circumstances.

The area of occupancy (Ao) was estimated as the percentage of cells in each hectare occupied by *E. virgata*.

The abundance of *E. virgata* per ha was estimated by summing the 10 counts and calculating the mean per sample and multiplying by the Ao. The variance about the best estimate was also calculated. The estimate used for mapping purposes is the best estimate.

A fire in January 2010 burned most of the Mt Vulcan resource area and very few unburnt *E. virgata* remain. Estimates of the density of *E. virgata* in areas added to the drilling program are based on our judgement of the similarity of habitat to

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<sup>1</sup> RMC, DPIW

<sup>2</sup> Bryant & Jackson (1999)

adjacent hectares. This approach is conservative and may estimate a more realistic carrying capacity than trying to count post fire regeneration at this early successional stage. *E. virgata* is virtually impossible to see for some years after a fire.

Due to the low numbers of *Tetratheca gunnii* and *Spyridium obcordatum* encountered all plants would be counted if encountered.

Any symptomatic evidence of plant pathogens and weeds were recorded using hand held GPS.

Botanical nomenclature follows the current census of Tasmanian plants<sup>3</sup>.

## **2.3 FAUNA HABITAT ASSESSMENT**

The vegetation was related to fauna habitat with respect to threatened fauna species known from the area, or considered to potentially occur there. The presence of habitat structure such as old growth trees, water, rock ledges and logs were all noted. Floristic and substrate preferences such as those reported for the New Holland Mouse were recorded.

An owl call back survey was undertaken on 2 evenings. Other nights were unsuitable due to high winds.

## **2.4 ASSESSMENT OF CONSERVATION SIGNIFICANCE**

Vegetation types have been classified according to TASVEG<sup>4</sup>. The State and Federal Governments are committed to achieving a Comprehensive Adequate and Representative (CAR) Reserve System based on TASVEG mapping.

The reservation target of a vegetation type relates to its current extent compared with the modelled extent prior to European settlement. This comparison provides an estimate of the proportion lost due to land clearing. Those vegetation types that have suffered considerable loss (approaching 70% or more) are considered to be “threatened”. A 2006 amendment to the Nature Conservation Act 2002 allows the Minister to list threatened native vegetation communities<sup>5</sup>.

For forests, reservation targets were set using the nationally agreed JANIS criteria as part of the Tasmanian RFA. The reservation targets reflect the extent of loss with “threatened” vegetation types having high targets. The JANIS principles also include the consideration of the bioregional representation of each vegetation type within the CAR reserve system.

The most recent bioregional and state analysis of forest communities was completed in 2007 for the Forest Conservation Fund<sup>6</sup> which recalculated areas required to achieve a CAR Reserve system based on the RFA modelling. No similar modelling has been undertaken for the current TASVEG non forest communities, although the reservation at state and bioregional level has been calculated for all TASVEG 2 communities<sup>7</sup>.

Vegetation matters of national environmental significance (MNES) are listed on the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*

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<sup>3</sup> Buchanan (2009)

<sup>4</sup> Harris & Kitchener 2005

<sup>5</sup> Schedule 3a NCA 2002

<sup>6</sup> FCF 2007

<sup>7</sup> DPIPWE 2010

(EPBCA). *Lowland Native Grassland of Tasmania* includes two such communities for which defining criteria must be met in order for a patch of grassland to qualify as a MNES.

The conservation significance of species is determined at a State and Federal level by the Tasmanian *Threatened Species Protection Act 1995* and Commonwealth EPBCA (Appendix 1), the implications of which are considered in the light of the relevant legislation (Appendix 2).

## 3. BIOLOGICAL VALUES

### 3.1 THE VEGETATION

Table 1 describes the conservation and reservation status of the native plant communities. The vegetation types are described below and a list of species is given in Appendix 3. The native vegetation has been classified into native plant communities listed in Table 1. The distribution of vegetation types is illustrated in Figure 2.

Existing Tasveg mapping (version 2.0) identifies the study area to be dominated by dry *Eucalyptus obliqua* forest (DOB) and Coastal *E. amygdalina* forest (DAC) with lesser coverage of damp sclerophyll forest (DSC) and plantation and minor occurrences of *E. ovata* forest (DOV). While all of these vegetation types proved to be present we found that the extent of each is different to that of Tasveg and additional communities occur. In particular we note that a significant portion of the forest mapped as DAC occurs on Tertiary laterite gravels and as such we judge it to be *E. amygdalina* on Cainozoic sediments (DAZ). However, we were instructed by DPIPWE senior botanist to classify it as DAC to remain consistent with the Tasveg description of forest on ultramaphic substrates and the existing Tasveg mapping (Steve Harris Pers. Comm).

#### ***Eucalyptus amygdalina* Coastal forest (DAC)**

This forest type occurs on siliceous gravels, metamorphic rocks and recent sands. The Tasveg classification places forest on ultramaphic substrates in DAC. In the study area the red earths (saprolite) and serpentinite have been attributed to DAC. Both are derived from weathering of ultramaphic rock. Forest and woodland in association with serpentinite is the habitat most likely to support *Tetradlea gunnii*. *Spyridium obcordatum* occurs occasionally where the serpentinite outcrops.

In the forest most closely associated with serpentinite outcrops *E. ovata* is often co dominant and the sub canopy of *Allocasuarina littoral* is replaced by a closed heath understorey. The heath varies in a small scale matrix from low heath to scrub. The low heath is very strongly characterised by *Baeckea ramosissima*, *Hibbertia riparia* with *Epacris virgata*. As the density and height of *Epacris virgata* increases the structure tends to scrub with the addition of *Leptospermum scoparium*.

Where the substrate is siliceous the most obvious distinguishing characteristic from DAZ and DAC on ultramaphics is the presence of *Lepidosperma concavum* as the predominant sedge. Other distinguishing species are *Acacia terminalis*, *Amperea xiphoclada*, *Persoonia juniperina* and *Stylidium graminifolia*. Species characteristic of DAC on ultramaphics, particularly *B. ramosissima* and *Hibbertia riparia*, are present in lower cover.

***Eucalyptus obliqua* Dry forest (DOB)**

This community consists of regrowth *E. obliqua* with occasional old growth trees throughout. This forest occupies both quartz rich and laterite soils. The laterite facies being on southern aspects.

In some situations on the siliceous substrate *E. amygdalina* is co dominant but *E. obliqua* remains more important. The understorey is dominated by *Allocasuarina littoralis* and *Banksia marginata* with *Lomatia tinctoria* and *Pultenaea gunnii* the most common shrubs. Grasses are very sparse and *Pteridium esculentum* is the only common fern.

***Eucalyptus ovata* dry woodland (DOV)**

This forest type is restricted to minor creek lines on alluvium. It is a shrubby facies which occurs closest to the drainage lines. *Leptospermum lanigerum* and or *L. scoparium* form an open scrub with *Banksia marginata* and *Acacia melanoxylon* and *A. verticillata* also present in the understorey. Other characteristic species include *Gahnia grandis*, *Gleichenia microphylla*, *Pultenaea dentata* and *Lepidosperma longitudinale*.

**Table 1: Native Plant Communities, Conservation Status, Extent and Area Reserved.**

Equivalent described floristic community <sup>8</sup>	Equivalent Mapped Tasveg Mapping unit	State-wide Conservation Status <sup>9</sup>	Regional Conservation Status <sup>10</sup>
<b><i>Eucalyptus amygdalina</i> forest</b>			
Dry- hAM-co Dry- hAM-serp	<i>Eucalyptus amygdalina</i> forest on sand, siliceous gravels saprolite and serpentinite  (DAC)	Not threatened Adequately reserved 151 697 ha 62 000 ha reserved	Not threatened Adequately reserved 18 400 ha 7 000 ha reserved
<b><i>Eucalyptus obliqua</i> dry sclerophyll forest</b>			
Dry-shOB-arg Dry-shPB-Silic	<i>Eucalyptus obliqua</i> dry forest (DOB)	Not threatened Adequately reserved	Not threatened Adequately reserved
<b><i>Eucalyptus ovata</i> woodland</b>			
Dry-sd-OV	<i>Eucalyptus ovata</i> shrubby forest and woodland  DOV	Endangered 13 400 ha 3 500 ha reserved	Endangered 3 800 ha 600 ha reserved
<b><i>Eucalyptus obliqua/ E. amygdalina/ E. ovata</i> forest</b>			
Damp Sclerophyll forest	<i>Eucalyptus obliqua</i> , <i>E. Ovata</i> , <i>E. amygdalina</i> mixed dominance  (DSC)	Not threatened 49 800 ha 13 400 ha reserved	Not threatened 33 900 ha 9 700 ha reserved

<sup>8</sup> North et al 1998, Kirkpatrick et al 1995.

<sup>9</sup> DPIPWE 2010 Tasveg 2 analysis (State wide)

<sup>10</sup> DPIW 2006 – Tasveg 1.1 tenure analysis (bioregional)



*E. ovata* forest



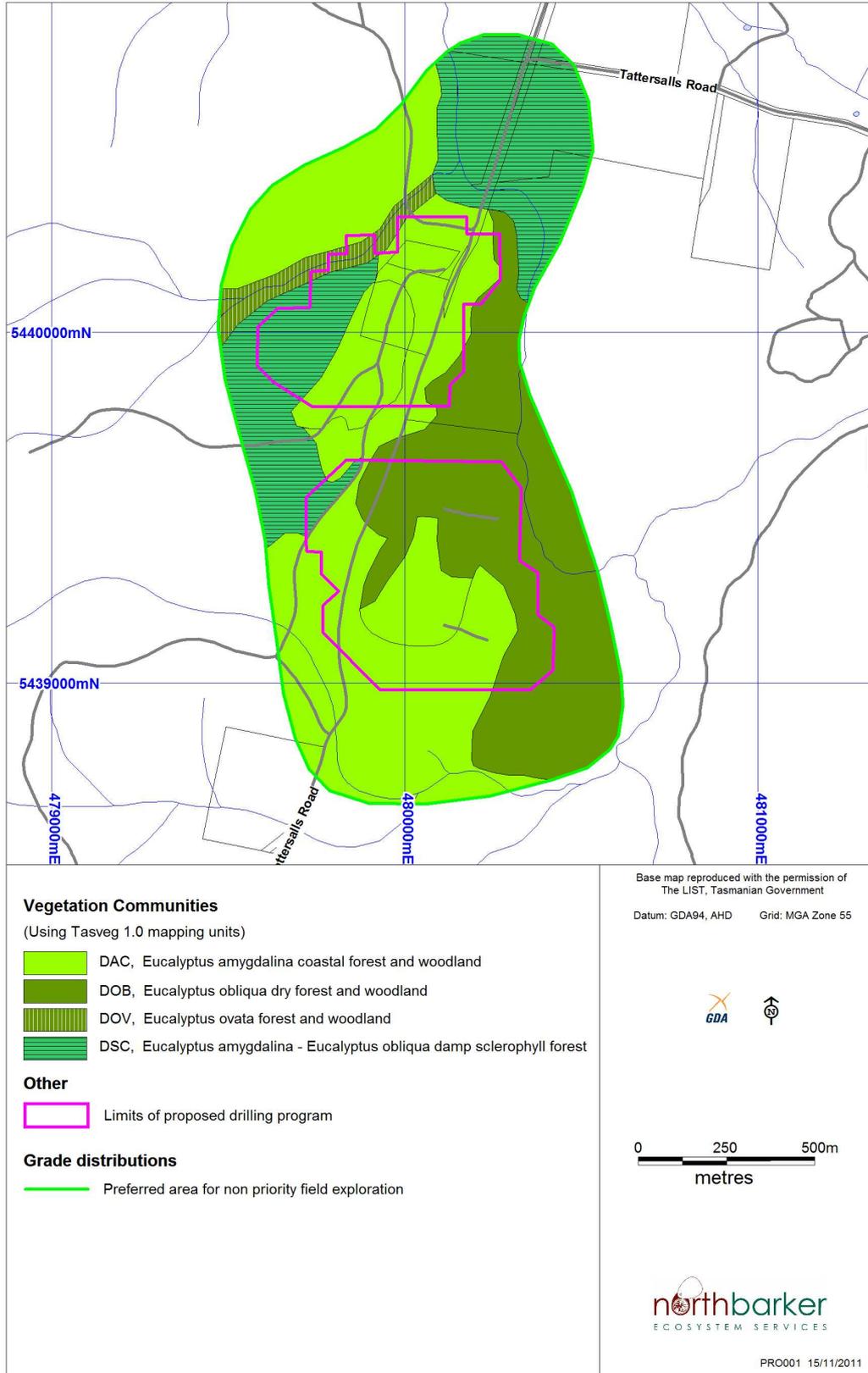
*E. amygdalina* on tertiary iron stone gravels (DAZ)



Damp sclerophyll forest.



*E. obliqua* dry forest



**Figure 2. The distribution of vegetation communities at Mt Vulcan.**

### 3.2 FLORA OF CONSERVATION SIGNIFICANCE

The survey revealed 201 native plant species. Of these, 13 are endemic to Tasmania. There are eleven species that are introduced. A list of species recorded in the study area is given in Appendix 3. Table 2 identifies significant species previously recorded within 5 km radius of the study area from Natural Values Atlas, DPIW and those recorded in this survey. It also includes relevant species identified on the EPBC Protected Matters database for 5km radius.

#### EPBC listed flora

Three plant species listed by the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* were recorded in the proposed lease area. These are:

1. *Epacris virgata*
2. *Tetratheca gunnii*
3. *Spyridium obcordatum*

#### Tasmanian Threatened Species Protection Act listed flora

The three species listed above are also by the Tasmanian *Threatened Species Protection Act 1995*. Two additional rare species listed on this act were recorded; *Ehrharta juncea* and *Pimelea curviflora* var. *gracilis*. *E. juncea* was found only occasionally within the Barnes Hill resource block while *P. curviflora* was found in the Mt Vulcan block but away from the drilling program.

**Table 2: Flora Species of Conservation Significance Recorded, Previously Recorded or which may occur in the Vicinity .**

Species	Status TSPA EPBCA	Potential to occur	Preferred habitat <sup>11</sup> , suitability of study area and observations
<b>Known from within 500 m</b>			
<i>Acacia sicutiformis</i> dagger wattle	Rare	<b>Low</b>	Occurs on fertile (dolerite) soils in riparian and other rocky situations. Substrate very limited in study area, not found. Record precision +/- 4 km.
<i>Acacia ulicifolia</i> Juniper wattle	Rare	<b>Low</b>	Occurs in open sandy heaths. Very limited potential habitat, heath not typical for this species. Not found. Record from quartz soils east of Mt Vulcan.
<i>Brachyscome sieberi</i> var. <i>gunnii</i> forest daisy	Rare	<b>Previously recorded.</b>	Known to be very widespread from a range of habitats. Previously recorded at Dan's Hill. Not found during this survey.

<sup>11</sup> Lazarus *et al.* 2003.

Species	Status TSPA EPBCA	Potential to occur	Preferred habitat <sup>11</sup> , suitability of study area and observations
<i>Epacris virgata</i> pretty heath	Vulnerable Endangered	<b>Present</b>	Occurs in heaths on serpentine soils. Habitat common recorded in both resource blocks.
<i>Spyridium obcordatum</i> dusty miller	Vulnerable Vulnerable	<b>Present</b>	Occurs on dolerite and serpentine outcrops. Occasional in study area in low numbers.
<i>Tetratheca gunnii</i> shy Susan	Endangered Critically endangered	<b>Low Moderate</b>	Occurs in open low heaths, saggy woodlands and <i>Allocasuarina</i> dominated understorey on serpentine and closely associated and related laterite soils. Known and found occasionally in a widespread distribution. Potential habitat present.
<i>Westringia angustifolia</i> narrow leaf westringia	Rare	<b>Low</b>	Known from dry shrubby under storeys of sclerophyll forests and on river banks. Record from vicinity is from east of the Barnes Hill resource block.
<i>Xanthorrhoea bracteata</i> shiny grass tree	Vulnerable Endangered	<b>Low</b>	Habitat typically low lying acid soils. Potential habitat present but not observed and very unlikely to occur. The record from the vicinity is north of the Barnes Hill resource block.
<b>Known from within 5000 m</b>			
<i>Brunonia australis</i> blue pincushion	Vulnerable Not listed	<b>Low</b>	Occurs in grassy forest on ironstone gravels and alluvial soils. Not known from potential habitat the study area. A very conspicuous species not likely to be overlooked.
<i>Ehrharta juncea</i> forest wiregrass	Rare	<b>Present</b>	Confined to the north of the state, prefers wet forests and disturbance. Found to be occasional in shrubby forest on saprolite at Barnes Hill resource block. Low risk of impact, none anticipated.
<i>Phylloglossum drummondii</i> pygmy clubmoss	Rare	<b>Low</b>	Typical habitat is wet peaty soils with open vegetation. No suitable habitat.
<i>Pimelea curviflora</i> var. <i>gracilis</i> Slender curved rice flower	Rare	<b>Present</b>	Predominantly in north of Tasmania in wet forests or protected slopes of dry forests. Found on southern slopes of Settlement Hills. Not impact anticipated.
<i>Pomaderris oraria</i> coast pomaderris	Rare	<b>Low</b>	Typical habitat is on dunes and in coastal low <i>Allocasuarina</i> forest. The forest present is of the inland form.

Species	Status TSPA EPBCA	Potential to occur	Preferred habitat <sup>11</sup> , suitability of study area and observations
<i>Pterostylis atriola</i> snug greenhood	Endangered Endangered	<b>Moderate</b>	The known sites are widespread in shrubby open eucalypt forest on well-drained stony soils. They are relatively cold environments including frost hollows, gorges and exposed ridges. Flowers Jan-April. Limited potential habitat is present.
<i>Pterostylis grandiflora</i> superb greenhood	Rare	<b>Moderate</b>	Sandy and loamy soils in shrubby forest and <i>Allocasuarina</i> forest. Potential habitat occurs in DAC. Flowers April to August.
<i>Pultenaea hibbertioides</i> guinea flower bush pea	Vulnerable Not listed	<b>Low</b>	Occurs in shrubby dry sclerophyll forests on quartz clays. Suitable habitat restricted to quartz gravels and clays. Unlikely to be overlooked.
<i>Senecio squarrosus</i> leafy fireweed	Rare	<b>Moderate</b>	Broad range in dry sclerophyll forest. Flowers October to December. Potential habitat present. Unlikely to be overlooked.
<i>Spyridium parvifolium</i> var. <i>parvifolium</i> coast dustymiller	Rare	<b>Low</b>	Occurring in a range of habitats including riparian, rocky slopes, open woodland and heath. Potential habitat present. Not recorded and unlikely to be overlooked.
<i>Thelymitra Antennifera</i> rabbit ears	Endangered Not listed	<b>Low</b>	Coastal heathlands on peaty and sandy soils. Limited potential habitat on sands. Flowers September to early November. Not recorded.
<i>Thelymitra holmesii</i> bluestar sun-orchid	Rare	<b>Moderate</b>	Heathland and heathy open forest on clays with poor to moderate drainage often on margins of swamps. Flowers Nov and Dec. Limited potential habitat. Majority of site on stony and gravelly soils, laterite loams and alluvium. Limited potential.
<i>Veronica plebeia</i> trailing speedwell	Rare	<b>Low</b>	Wet sclerophyll forests on dolerite. No suitable habitat.

***Epacris virgata* Hook, f., Lond. J. Bot. 6:271 (1847). (pretty heath)  
(vulnerable TSPA, Endangered EPBC)**

*Epacris virgata* has been the subject of considerable taxonomic review over the past decade and more. The distribution has two clearly disjunct occurrences; one in the north of Tasmania around Beaconsfield and the other in the south around Kettering. The most recent work concludes that although there is genetic differentiation between the two, which is not surprising given the geographic distance between them, there is no morphological difference.<sup>12</sup> Consequently, there is no means of differentiation using a floristic key.

<sup>12</sup> Crowden 2007

Conservation assessments have been completed by DPIW on the basis of two distinct taxa.<sup>13</sup>

The EPBC listing clearly indicates that the endangered status covers the Beaconsfield population only.

The TSPA listing is ambiguous in as much as the vulnerable status appears to include both of the populations, consistent with Hooks original description, but each is assessed separately.

A conservation assessment of the combined population data from the states north and south locations could indicate a that this species does not meet the criteria for listing on the TSPA or the EPBC.

We have found *Epacris virgata* to be common and widespread across the vicinity and now estimate the population to be in excess of 3 million plants (North Barker 2010).



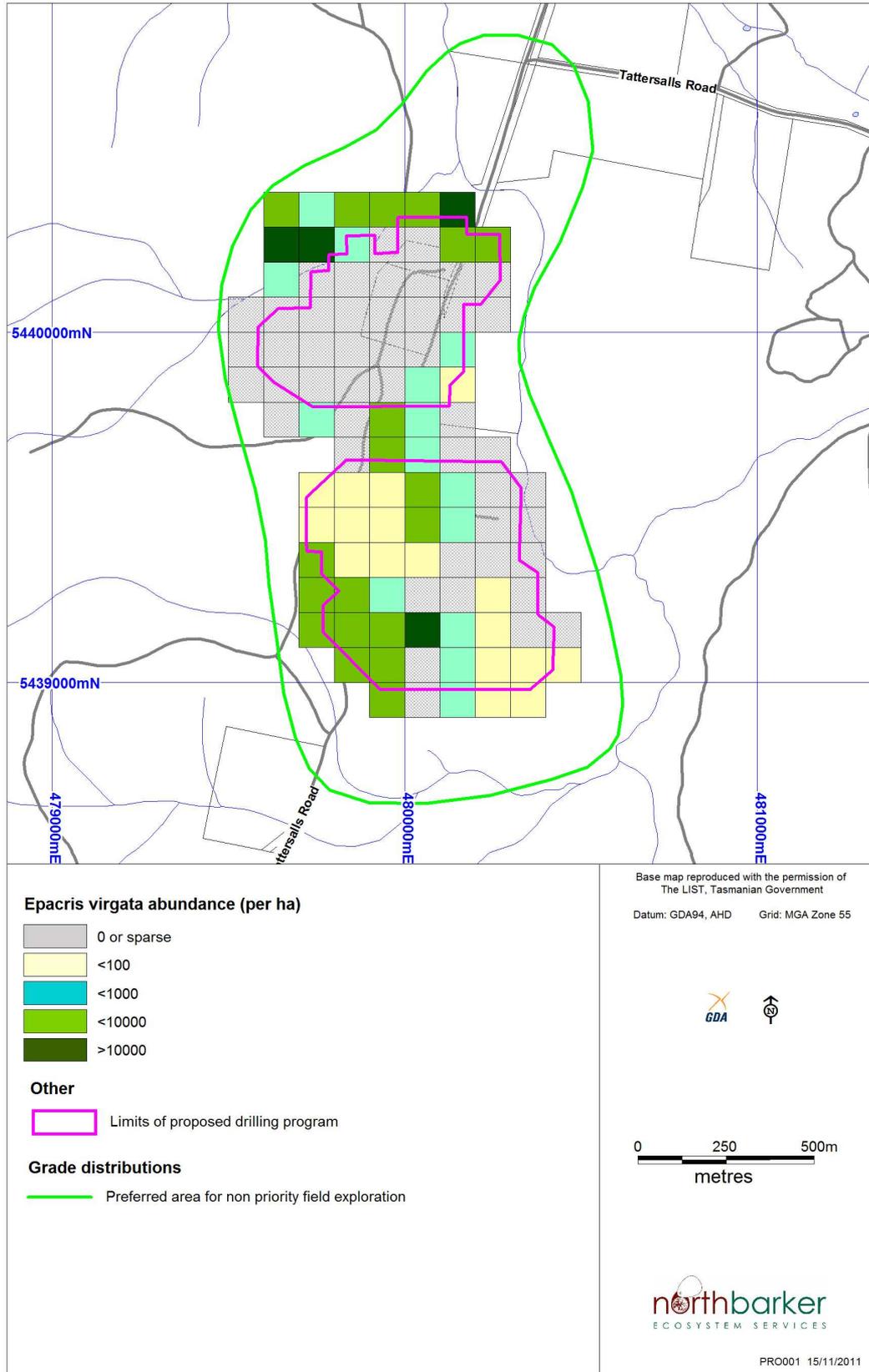
**Photo. *Epacris virgata*.**

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<sup>13</sup> Keith 1998 and Black 2000



**Photo. *Tetratheca gunnii*.**



**Figure 3. The distribution and abundance of *Epacris virgata* at Mt Vulcan.**

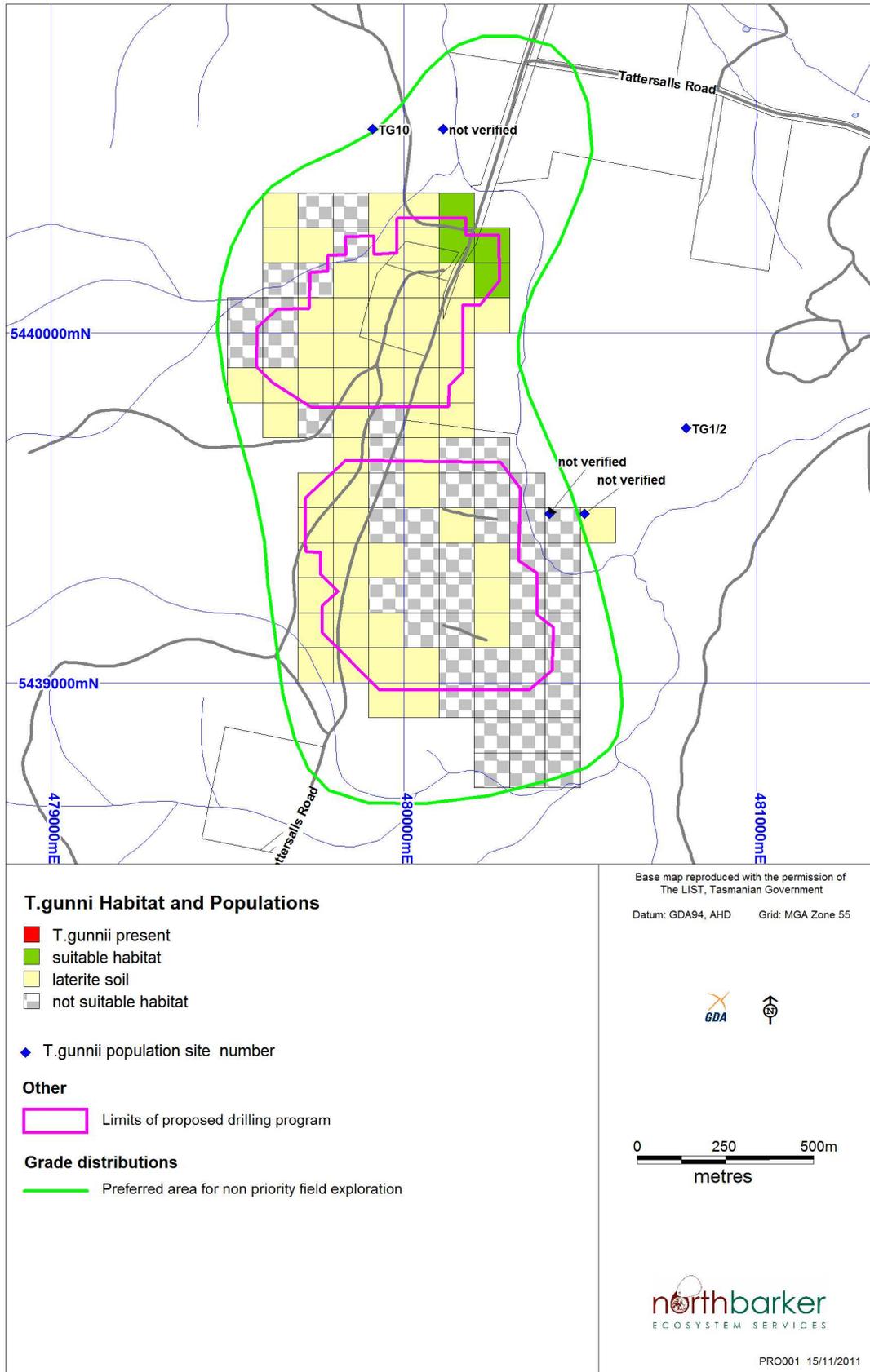
***Tetratheca gunnii* (endangered TSPA, Critically endangered EPBC)**

*Tetratheca gunnii* is likely to be one of the most endangered species in Tasmania. It may be at a high risk of extinction if the causes of decline cannot be reversed.

Hook described *T. gunnii* from the foot hills of the Dazzler Range in 1855. Although restricted in area there was no indication that the plant wasn't reasonably common in suitable habitat. These days it is extremely difficult to find. It also appears from Hook's description of the habitat at that time was much more open than at present. It may be that the factors that have led to a change in the structure of the habitat have also resulted in the decline of *T. gunnii*. Two factors that are known to have changed significantly are the frequency of fire (decreased) and the intensity of grazing which has increased and includes the introduction of the rabbit.

As part of this research Barker (1996) showed that the percentage of flowers that resulted in seed annually was so low (less than 1%) that the maintenance of a soil seed bank would be difficult. Subsequently it was shown that seed set and size was dramatically increased with cross pollination. It seems that *T. gunnii* had become so rare and scattered in the landscape that cross pollination had become extremely difficult; resulting in very few seeds being produced. Consequently, the replacement of existing plants with a new generation from a perpetual soil seed bank would be difficult. Research in Western Australia indicated that the majority of pollen was transported less than 10m by pollinators among local *Tetratheca* species (Bell pers. Comm.).

There are 12 subpopulations of *T. gunnii* in Proto's EL. None of those occur within the area of the drilling program. Two nearby records are thought to be imprecise locations of existing sites. Both were recorded pre GPS. There is a low probability of *T. gunnii* occurring within the area of the drilling program. Figure 4 indicates the extent of suitable habitat.



**Figure 4. The distribution of known populations and extent of potential habitat for *Tetraetheca gunnii* at Mt Vulcan.**

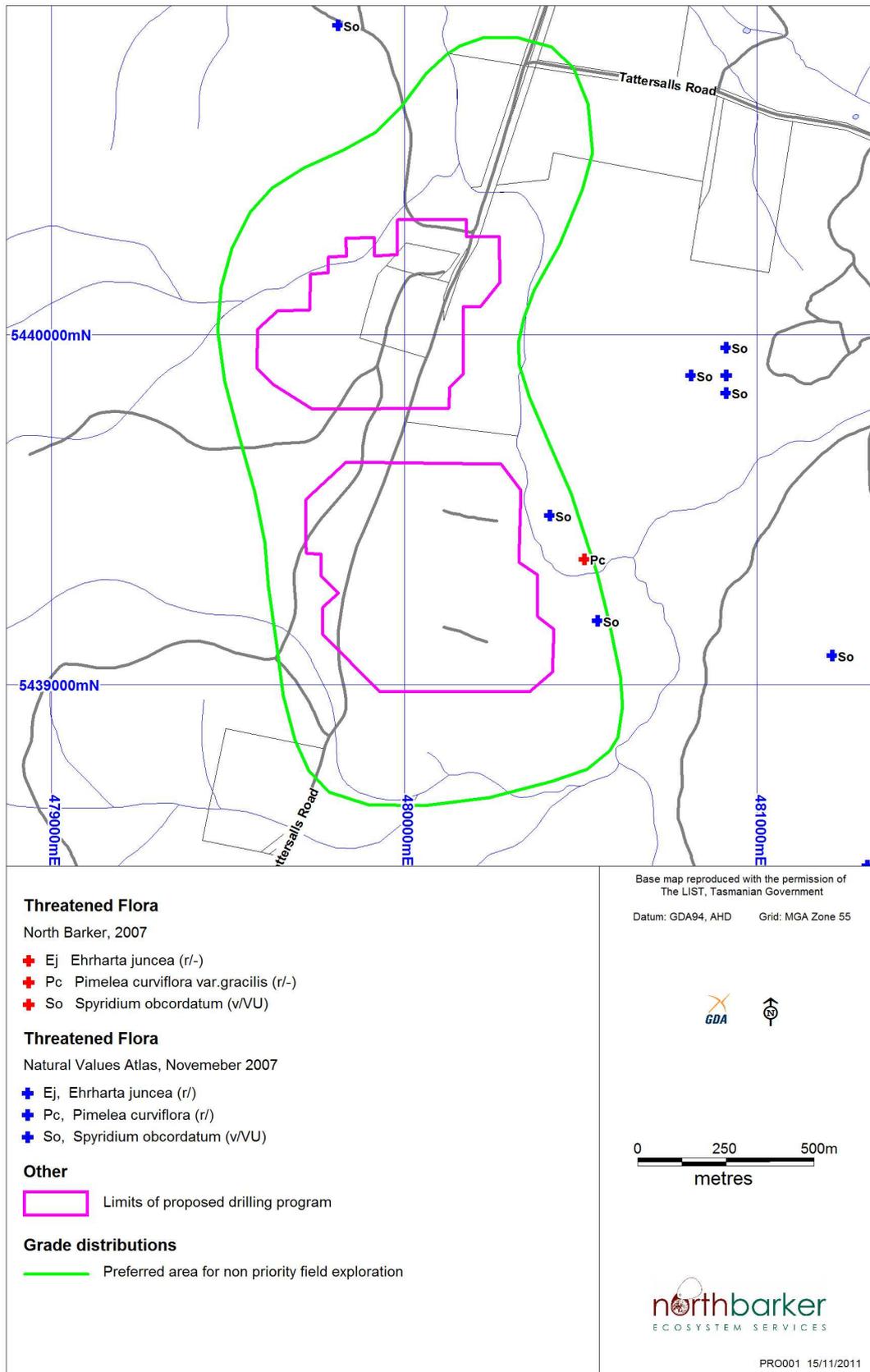
***Spyridium obcordatum* (Vulnerable TSPA and EPBC)**

This plant is restricted to the Port Sorrel, Asbestos Ranges and Beaconsfield areas. It is known from rocky dolerite soils at Port Sorrel and serpentine outcrops at Beaconsfield. It was found to be occasional and in low numbers. We may have overlooked it in small patches of suitable habitat as is difficult to distinguishing the small leaves (<5 mm) among a dense sward of other species with similarly coloured and sized leaves.

23 plants were recorded in the Barnes Hill resource block in 2007 but none were recorded at Mt Vulcan then or in 2011. They are known to occur more widely in the vicinity but tend to be on the outcropping serpentinite along ridges such as at Dan's Hill and west of Tattersall's Road. No such outcrops occur at Mt Vulcan.



**Photo. *Spyridium obcordatum***



**Figure 5. The distribution of *S. obcordatum*, *E. juncea* and *P. curviflora gracilis* from this survey and NVA records.**

### 3.3 FAUNA HABITAT

The forest of the lease area varied in structure and substrate. The complex structure in much of the forest provides a range of opportunities for cover and nesting for small birds and mammals. In the more open understoreys diggings of echidna and bandicoot were very common. Scats of the tasmanian devil were common. Denning habitat was also occasional as rocky terrain outside of the drilling program. Whites skink was also occasional in open rocky areas with sagg. Old growth trees with large hollows are occasional throughout the forested areas and large logs are more rare. Andersons creek is a permanent creek line with natural snags and bank undercuts. There is very little other free water except where road crossings inhibit drainage. In these circumstances frogs are common.



Photo. Whites skink

### 3.4 FAUNA OF CONSERVATION SIGNIFICANCE

Table 3: Fauna of conservation significance previously recorded within 5 km radius or likely to occur within the study area, or listed for the area on EPBC database and relevant.

Species	Status <sup>14</sup> TSPA/EPBCA	Potential to occur	Observations and preferred habitat <sup>15</sup>
<b>BIRDS (nests)</b>			
grey goshawk <i>Accipiter novaehollandiae</i>	Endangered	Low	There is potential nesting habitat along protected reaches of Andersons Creek. No nest sites are known from the area and it is outside of the core habitat range. No habitat occurs in the area of the drilling program.
wedge-tailed eagle	Endangered/	Very Low	No nests were observed during the

<sup>14</sup> National - Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* including JAMBA, CAMBA and Migratory species; State - Tasmanian *Threatened Species Protection Act, 1995*.

<sup>15</sup> Bryant & Jackson 1999; Bill Brown, DPWI, pers.comm., November 2007 re: eagle nests.

Species	Status <sup>14</sup> TSPA/EPBCA	Potential to occur	Observations and preferred habitat <sup>15</sup>
<i>Aquila audax fleayi</i>	Endangered		survey. Known nest sites occur on the slopes of the Dazzler Range. Suitable habitat is restricted to the slopes of Dans Hill but it is unlikely to support a nest in light of the number of nests on Dazzler Range. No impact anticipated.
white-bellied sea-eagle <i>Haliaeetus leucogaster</i>	Vulnerable/ Migratory	Low	The sea eagle is less likely than the WTE to nest at this site. No impact anticipated.
masked owl <i>Tyto novaehollandiae castanops</i>	Endangered/ Vulnerable	High	The general area is suitable habitat for this owl. Requires a mosaic of forest and open areas for foraging and large old-growth hollow-bearing trees for nesting. There are occasional old growth trees with hollows which may provide potentially suitable nesting sites. These will be avoided. No masked owls were observed or heard during call back survey in 2007. No impact anticipated.
<b>MAMMALS</b>			
spotted-tailed quoll <i>Dasyurus maculatus</i>	Rare/ Vulnerable	Present	Suitable habitat is widespread in study area. It is known from the in the vicinity. Quoll scats are present. Almost certainly part of the range of a population. No significant impact likely as the proposed scale of drilling operation is low impact on habitat.
Tasmanian devil <i>Sarcophilus harrisi</i>	Endangered/ Endangered	Present	Scats frequent on roads and in bush. Likely to be present in low to moderate density despite the impact of DFTD. No impact anticipated.
Eastern barred-bandicoot <i>Perameles gunnii</i>	-/Vulnerable	High	Previously recorded in the area. Although not generally a grassy habitat there are localised grassy patches and there is suitable dense undergrowth for cover. If present it is likely to be infrequent. No impact anticipated.
New Holland mouse <i>Pseudomys novaehollandiae</i>	Endangered/ Vulnerable	Low	Single previous record of the species in the vicinity is of unknown spatial accuracy and does not appear to be in suitable habitat. The preferred habitat of this species is coastal dry heath on a sandy substrate with and dense and floristically diverse understorey although it has been found in a variety of habitats including woodland with an open understorey. No impact anticipated.
<b>INVERTEBRATES</b>			
giant freshwater crayfish <i>Astacopsis gouldii</i>	vulnerable Vulnerable	Nil	Andersons Creek flows to the Tamar River. No giant freshwater crayfish occur in the Tamar River Catchment.
central north burrowing crayfish <i>Engaeus granulatus</i>	e	Nil	This species range does not extent to the Tamar catchment.

Species	Status <sup>14</sup> TSPA/EPBCA	Potential to occur	Observations and preferred habitat <sup>15</sup>
snail (cataract gorge) <i>Pasmaditta jungermanniae</i>	r	Nil	<i>Pasmaditta jungermanniae</i> is known only from the Cataract Gorge and nearby locations. Its habitat is mossy rocks and tree roots above the water line.  Taxonomic status unclear, may be a variant of <i>P. luckmanii</i> .
<b>AMPHIBIANS</b>			
Green and Golden Frog <i>Litoria raniformis</i>	Vulnerable/ Vulnerable	Low	Requires permanent fresh water for breeding, preferably shallow water with diverse emergent vegetation. No suitable habitat within the impact areas. That is no drilling will occur in wetlands or creeks.
<b>FISH</b>			
Australian Grayling <i>Prototroctes maraena</i>	Vulnerable/ Vulnerable	Low	Inhabits the middle and lower reaches of rivers and streams that open to the sea. Andersons Creek opens to Tamar estuary.  If present no impact is anticipated on any drainage to Andersons creek.

### **Fauna listed on the EPBC that may be affected by the proposal.**

#### **Wedge-tailed eagle (*Aquila audax ssp. fleayi*)**

This is an endemic subspecies of Australia's only *Aquila*. This species is listed as endangered on the EPBC and the TSPA. Adults are resident, highly territorial and have very large home ranges (density of 1 pair per 20 km<sup>2</sup> to 1200 km<sup>2</sup> depending on productivity of habitat). Although considered to be widespread but uncommon at the time of European settlement the breeding success has decreased to a point where it is now considered that fewer than 100 pairs are successful at breeding each year in Tasmania. Wedge-tailed Eagles nest in a range of mature trees almost exclusively eucalypts. Territories can contain up to five alternative nests usually close to each other but may be up to 1 km apart where habitat is locally restricted. The greatest single threat to the species is the continuing decline in breeding success as a result of disturbance of breeding birds and loss of nesting habitat.

A record from 1800 indicates a nest from the Simmonds Hill area to the south west of Barnes Hill. No nest exists there today. Nest searches associated with the location of infrastructure for the proposed Barnes Hill mine did not locate any nests in the vicinity of Mt Vulcan.

#### **Tasmanian devil (*Sarcophilus harrisii*)**

The threatening process is the facial tumour disease. It is listed on the Tasmanian *Threatened Species Protection Act 1995* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* as endangered.

The Tasmanian Devil is primarily a carrion-eater which is generally nocturnal. During the day it will retire to a cave, hollow log or thick scrub. At night it forages

over a range of 10 to 20 hectares. The animals are solitary but not territorial and foraging ranges may overlap considerably<sup>16</sup>.

This species is not currently threatened by habitat loss and has proven to be tolerant of habitat modification. Due to the reduction in numbers increasing importance is placed upon the protection of maternal dens.

The vicinity of the drilling program supports a population of Tasmanian devils evident from the frequency of scats of different ages. However, within the Mt Vulcan drilling area den opportunities are few and no dens were recorded.

### **Fauna listed on the TTSPA for which the site may be significant.**

#### **Grey goshawk (*Accipiter novaehollandiae*)**

The Tasmanian morph is exclusively white in colour. It is typically associated with rainforest, wet forest and swamp forests with a preference for nesting in blackwoods often in gullies and streamside situations. Nest sites are often reused in following seasons but are not permanent. There are only approximately 100 known nesting pairs in Tasmania.

There is currently no listing statement of recovery plan under the *Threatened Species Protection Act 1995* for this species which would provide additional information on habitat preference and key threatening processes. 'Core breeding habitat' is defined as including 'streamside blackwood forest in the north west' which does not include the study area.

Non breeding juveniles and sub-adults are known to disperse to areas away from core breeding habitat. Two sightings have been reported from the vicinity.

The stream side forest along protected parts of Andersons Creek support broadleaf sub canopies including blackwood below open eucalypt forest which provide a limited amount of potential habitat.

#### **Australian grayling (*Prototroctes marina*)**

Australian grayling live in the middle and lower reaches of rivers and streams that open to the sea. They have been recorded at considerable distances from the sea and at significant altitudes in Victoria<sup>17</sup>. Much of their basic biology, including distribution and migratory behaviour, is unknown. Spawning takes place in moderately flowing fresh water in late spring to early summer with a large number of eggs laid on gravelly stream beds. Andersons Creek flows to the Tamar River estuary rather than open sea. The stream bed is sandy to gravelly and generally has a moderate flow of water in spring.

These fish can be threatened by disturbance and pollution of the gravelly beds on which they lay the eggs.

### **3.5 INTRODUCED PLANTS**

Two declared weed species – Spanish heath (*Erica lusitanica*) and gorse (*Ulex europaeus*) occur in the Mt Vulcan area (Figure 6).

There are two separate stands of about 10 pine trees each in the Mt Vulcan area. One associated with the Spanish heath. Both appear to mark the location of past settlements.

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<sup>16</sup> The Australian Museum 1983.

<sup>17</sup> Jean Jackson pers. Comm.. Inland fisheries Tasmania.

### 3.6 PHYTOPHTHORA

*Phytophthora cinnamomi*, commonly known as dieback (or PC), is a pathogen which affects a wide range of species, (notably those in the *Epacridaceae* and *Proteaceae* families). It is a soil borne fungal pathogen that invades the roots of plants and starves them of nutrients and water. Its activity is limited to a climatic envelope of greater than 600 mm rainfall pa in areas with a mean max daily temperature of greater than 12 deg C. In Tasmania this is generally below about 800 m asl. The project site falls within this suitable climatic zone.

Within this suitable climatic envelope some soil types are more conducive to the establishment and spread of *Phytophthora* than others. Conducive soils are generally the low nutrient types that support heathy communities. The combination of these biophysical factors results in patches of susceptible communities on conducive sites across the landscape.

A significant portion of species that occur in heathy vegetation are susceptible to disease. Many of the species in the DAC forest in the study area are susceptible.

There are records of *Phytophthora cinnamomi* laboratory isolations from *Lomatia tinctoria* and soil associated with *Tetralochea gunnii* closely associated with serpentine outcrops. These are near Tattersall's Rd about 2 km south of Mt Vulcan. However, there was no symptomatic evidence of *Phytophthora cinnamomi* noted from the saprolite soils. Nor is there any evidence of old infection fronts. It is possible that the volcanic mineral rich soils are not conducive to supporting *Phytophthora cinnamomi* despite the local infections reported above. These local infections have not spread as would be expected in conducive circumstances. However, this does not exclude the possibility of PC spores proliferating in these soils and being transported off site to susceptible vegetation.

This soil borne pathogen moves naturally through the soil, more rapidly with drainage, and more slowly upslope. It is transported long distances by animals and humans. *Phytophthora* can be accidentally introduced through the transportation of soil on vehicles, construction machinery and walking boots.

## 4. IMPACTS AND MITIGATION

The areas identified for drilling are illustrated in relation to habitat values at Mt Vulcan on figures 2-5. The proposed drilling program is based on 50 m centres.

Access to and between off track locations will be along transects. The precision of drilling locations will allow for the relocation of the centre to plus or minus 5 m in order to avoid values. This will allow important values to be avoided to some extent.

The drilling rig will be mounted on a truck. The type of drill rig is illustrated in the photograph below.



### 4.1 NATIVE VEGETATION

Of the two main forest types within the main drilling area (Figure 2) are DAC and DOB. Both are well reserved. *Allocasuarina* is predominant in the understorey and where it occurs the ground cover is sparse and so the impact on other ground vegetation will be low.

Where the *A. littoralis* is not dominant the understorey of the DAC is either open shrubby or heathy. In the open understorey tree removal will be limited. The heathy understorey supports a low dense ground cover. This understorey be disturbed by access but is unlikely to be killed by a single pass although full recovery may take several years.

No other vegetation type will be impacted by the drilling.

### 4.2 THREATENED FLORA

There is one threatened flora species known within the drilling area. *Epacris virgata*, The exploration areas surveyed for this species represents a small portion of the total area that is known to support it. The total population is considered to be in excess of 3 million plants in and adjacent to the Dans Hill Conservation Area (North Barker 2011).

#### Mt Vulcan

##### *Epacris virgata*.

The following estimates are based on pre fire assessments and post fire extrapolation. Of the approx. 111 700 plants (+/- 38 000) estimated to be in the study area it is not possible to precisely estimate how many plants would be affected by the access and drilling. However, assuming that the drilling rig will disturb 1 m width (tyre tracks) to access each of 5 locations per hectare (50 m centres) and 10 \* 10 m at each drilling location then a total area of about 700 m<sup>2</sup> will be disturbed. This is about 7 % of each hectare supporting *E. virgata*. The average area occupied by *E. virgata* in the study area is less than 2 500 m<sup>2</sup> or 25 % of each hectare. This provides considerable opportunity to manoeuvre when accessing each site to minimise disturbance to *E. virgata*. If all of the disturbance were to occur in the occupied habitat then the

maximum number of *E. virgata* that could be expected to be disturbed would be 11 000. This is calculated using the average plants per square m \* square m's expected to be disturbed (two traverses and 5 drill sites) and the area of occupancy.

$$\begin{aligned} \text{Estimate of number disturbed} &= 3 \text{ per m}^2 * 700 \text{ m}^2 * 31.5 \text{ ha occupied} * 0.25 \text{ Ao} \\ &\approx 16\,500 \end{aligned}$$

Most disturbed plants are likely to survive the drilling program. Inevitably some will not. The most likely to be killed are those directly removed by the drilling operation. However, this will be minimised by not centring the drill platform on dense patches. Drill operators will be made aware of this requirement. An estimate of the maximum potential losses is 1800 plants.

This estimate is based on mean density of 3 plants per m<sup>2</sup> and total loss of plants from 5 m<sup>2</sup> per drill location in 31.5 occupied hectares, 25 % of drill locations in occupied habitat based on 25% Area of occupancy (Ao).

$$\begin{aligned} \text{Estimate killed} &= 3 \text{ per m}^2 * 5 \text{ drill locations per ha} * 5 \text{ m}^2 * 31.5 \text{ ha occupied} * .25 \text{ Ao} \\ &\approx 590 \end{aligned}$$

The loss of approx. 590 plants represents 0.02% of the estimated 3 000 000 in all surveys to date in the range of *E. virgata* at Beaconsfield (North Barker 2010).

### ***Tetratheca gunnii***

Figure 4 indicates that no known locations of *T. gunnii* will be affected by the drilling proposal.

Figure 4 illustrates the distribution of suitable habitat for *T. gunnii*. The suitable habitat is coincident with a small area of the distribution of *E. virgata*. Within this area drilling will be confined to tracks.

### ***Spyridium obcordatum***

No *S. obcordatum* were found in the resource area. Figure 5 previous past records.

### ***Ehrharta juncea***

Figure 5 indicates that this species is only occasional and unlikely to be disturbed during the drilling program. If it were inadvertently disturbed it would almost certainly recover as it is known to respond well to disturbance<sup>18</sup>.

### ***Pimelea curviflora gracilis***

Figure 5 illustrates the only record for this species. It is outside of the range of drilling being on a steep southern slope away from any road.

## **4.3 THREATENED FAUNA**

Disturbance of habitat during the drilling program will not have a significant impact on any threatened fauna species at Mt Vulcan. Other than vegetation cover all physical habitat structures including trees with hollows, large logs, rock outcrops and water bodies will be avoided.

<sup>18</sup> Wapstra, M, French, B & Ashlin, T 2003, 'Distribution, habitat characteristics and conservation status of the forest wire-grass *Ehrharta juncea* (R.Br.) Sprengel (Poaceae) in Tasmania', *Tasforests* vol.14.

### **Grey goshawk**

Although the habitat is marginal for this species all stream side habitat will be buffered by 10 m (class 4) or 20 m (class 2 and 3) and all blackwood trees will be avoided.

### **Masked owl**

All large trees capable of supporting large main stem hollows will be avoided.

### **Wedge-tailed eagle**

Although no eagle nests were recorded during survey. No birds were observed hunting or flying over the vicinity during the most recent survey in October 2011.

### **Eastern barred bandicoot**

No significant impact is anticipated on this species. The small grassy areas tend to occur on serpentinite outcrops which are not the target of drilling and are rare within the drilling area.

### **New holland mouse**

Potential New Holland Mouse habitat is outside of the area of the drilling program.

### **Spotted-tailed quoll**

There will be no significant impact on spotted-tailed quoll. Potential denning sites will be avoided.

### **Tasmanian devil**

There will be no significant impact on tasmanian devil. Potential denning sites will be avoided.

### **Australian grayling and green and gold frog**

All standing water and streams will be avoided and drainage into all streams will be protected by 10 m buffers. Andersons creek will be buffered by 20 m if drilling occurs nearby.

## **4.4 PHYTOPHTHORA**

The introduction of machinery and vehicles in general presents an increased risk of spreading or introducing *Phytophthora* to communities at risk. Any impact will depend upon the susceptibility of the community. DAC is the most susceptible of the communities in the study area. This community has been attributed to siliceous gravels and to the red saprolite soils that are mapped as serpentinite on the 25 k geological map.

The greatest risk of spread of *Phytophthora cinnamomi* is from existing infections. There are no field observations in the Mt Vulcan drilling area.

Active management to continually limit the spread of *Phytophthora* is a focus of Tasmania's control strategy. A specific strategy toward this end will be implemented during the drilling program. The strategy is based on standard PC hygiene protocols, exclusion of known and symptomatic infection sites, drilling areas free of PC first and disturbed areas and areas at highest risk of supporting unknown PC infections last. Figure 6 illustrates the areas referred to in the dot point strategy below.

The strategy is as follows:

## General

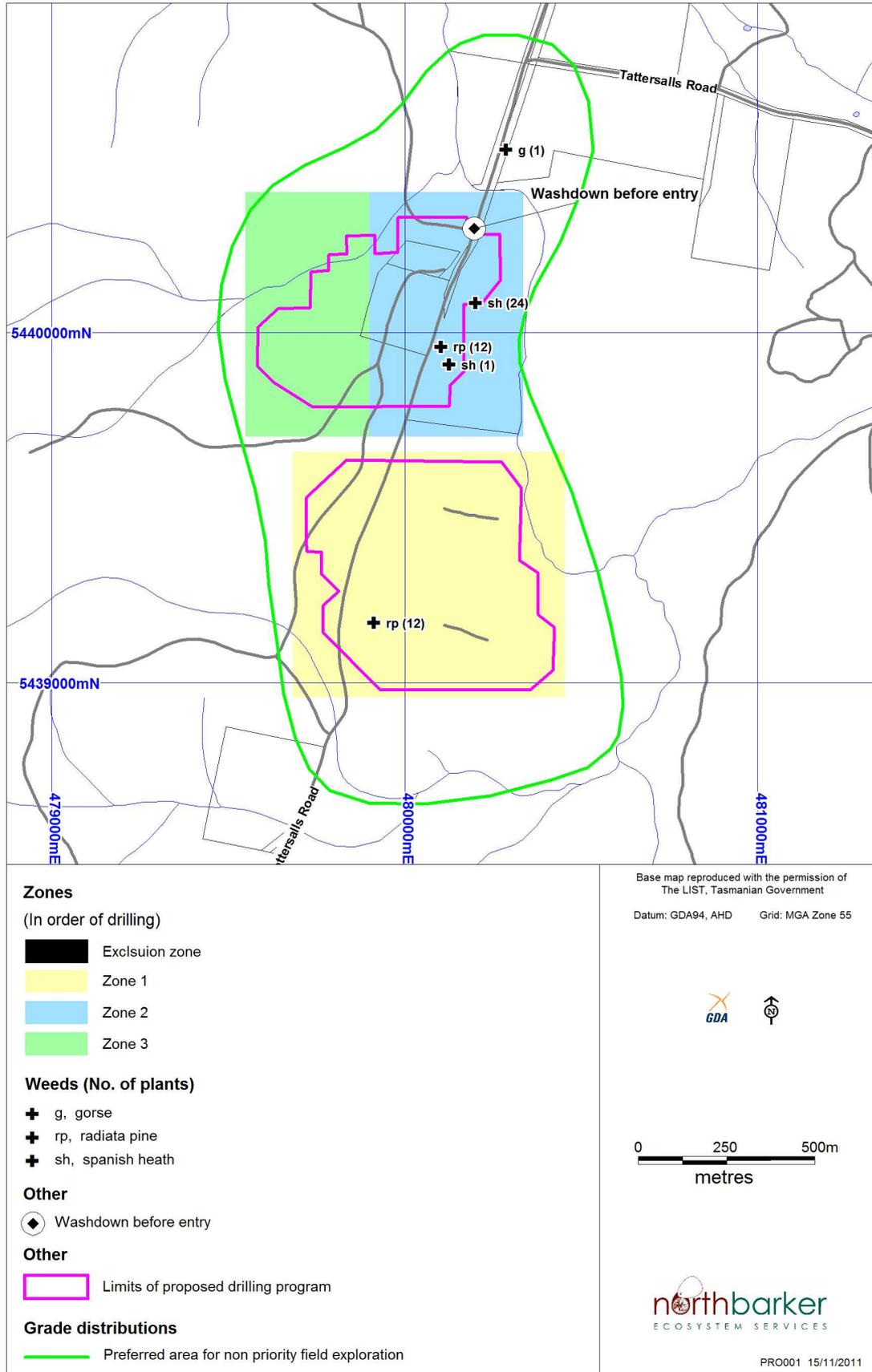
- Ensure that all personnel are familiar with:
  - This strategy
  - Symptoms of *PC* infection in vegetation
  - *PC* hygiene and wash down procedures that are detailed at:

[http://www.dpiw.tas.gov.au/inter.nsf/Attachments/LJEM-6HB8LN/\\$FILE/Interim%20Phytophthora%20Management%20Guidelines.pdf](http://www.dpiw.tas.gov.au/inter.nsf/Attachments/LJEM-6HB8LN/$FILE/Interim%20Phytophthora%20Management%20Guidelines.pdf).

- Clean all vehicles associated with the drilling program before entering the *PC* management areas.
- Restrict drilling operations to dry weather and firm soil.
- If an unmapped *PC* infection is encountered the drill location should either be moved to avoid the infection or else the equipment should be cleaned after drilling and before proceeding to the next drilling location.

## Mt Vulcan

- Confine all machinery to the drilling area for the duration of the drilling program.
  - If it is removed it should be cleaned before re entering.
- Exclude known infection areas from the drilling program.
- Confine drilling to existing access tracks to the extent possible.
- Begin the drilling program in the southern resource block.
- Move to the northern resource block and begin in the east.
- Finish the drilling program in the disturbed forest to the west and south.



**Figure 6. The distribution of weeds and records of PC and recommended order of drilling areas.**

## **5. LEGISLATIVE IMPLICATIONS**

Legal advice should be sought in regard to the following opinions.

### **5.1 COMMONWEALTH *ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999***

Referral under the EPBC Act will be necessary if, as the Act states:

‘An action has, will have, or is likely to have a significant impact on a vulnerable /endangered species if it does, will, or is likely to (amongst other things):

- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.’

Mineral exploration is normally exempt from the need to refer to the Minister. . In response to concerns raised by the EPBC compliance section a request was made by the Commonwealth to refer the Action.

The original drilling program was referred to the Commonwealth in 2008 for consideration of potential impact on all MNES. The minister judged that the program could proceed in the manner specified in the approval decision. In light of the very minor changes to the program and major expansion of the extent and abundance of the only species being directly impacted (*Epacris virgata*) in the adjacent reserves no new referral is recommended so long as it is undertaken in the manner specified in the approval decision.

### **5.2 TASMANIAN *THREATENED SPECIES PROTECTION ACT 1995***

Appendix 2 outlines the implications of threatened species in regard to the Act.

A permit to disturb *Epacris virgata* will be required before drilling can be undertaken.

### **5.3 TASMANIAN *WEED MANAGEMENT ACT 1999***

One “declared weed” – Spanish Heath was recorded in the Mt Vulcan resource block. This species is classed as a zone B weed for the West Tamar municipality with the emphasis on control and prevention of spread to zone A municipalities and habitats of threatened species and communities.

The eradication of spanish heath is achievable in the resource block.

### **5.4 TASMANIAN *LAND USE PLANNING AND APPROVALS ACT 1993***

LUPAA states that ‘in determining an application for a permit, a planning authority must (amongst other things) seek out the objectives set out in Schedule 1 <sup>19</sup>

Schedule 1 includes ‘The objectives of the Resource Management and Planning System of Tasmania’ which are (amongst other things):

‘To promote sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity’.

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<sup>19</sup> section 51(2) (b) – Part 4 Enforcement of Planning Control – Division 2 Development Control LUPA 1993

Sustainable development includes 'avoiding, remedying or mitigating any adverse effects of activities on the environment'<sup>20</sup>.

These objectives are met by:

- (i) Working within the conditions of permits under the TSPA.
- (ii) Reducing the risk of spread of declared and environmental weeds and plant pathogens (eg *Phytophthora*) during and after works.

## 6. SUMMARY AND RECOMMENDATIONS

A survey of two resource blocks at Barnes Hill and Mt Vulcan was undertaken in October and November 2007. The following threatened vegetation and fauna habitat values were recorded.

### Vegetation

#### Mt Vulcan

*Eucalyptus ovata* shrubby forest (DOV) 4.7 ha; endangered

*Eucalyptus obliqua* dry forest (DOB) 51 ha; not threatened

*Eucalyptus amygdalina* coastal forest (DAC) 83.5 ha; not threatened

*Eucalyptus* damp sclerophyll forest (DSC) 40 ha; not threatened

### Threatened Flora

The following threatened flora species listed on the *Environmental and Biodiversity Conservation Act 1999* and the *Tasmanian Threatened Species Protection Act 1995* were recorded:

*Epacris virgata* (Endangered EPBC vulnerable TSPA) – The following figures are based on measurements before a fire burnt the habitat in 2010. There are very few unburnt plants remaining and the abundance of regeneration is uncertain at this early stage. *E. virgata* is very difficult to observe or distinguish at this stage of succession and so the approach taken is conservative and may be a better estimate of carrying capacity than attempting to assess the immature regeneration. It is ecological protocol to count mature individuals when estimating the size of a population of a plant species.

We estimate that 111 700 (+-38 047) occur at Mt Vulcan extending over 55 ha. These figures are based on measurements before a fire burnt the habitat in 2010. There are very few unburnt plants remaining and the abundance of regeneration is uncertain at this early stage.

Based on the original estimates, the drilling program may disturb up to approximately 16 500 plants and may kill up to 590 plants.

*Tetratheca gunnii* (Critically endangered EPBC endangered TSPA)

No evidence of this plant was found in the earlier survey of during this review.

No known plants will be affected by the drilling program.

*Pimelea curviflora* (rare TSPA)

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<sup>20</sup> page 56 - LUPAA 1993

Found on the southern slopes of Settlers Hills. The site is outside of the proposed drilling program.

### **Threatened Fauna Habitat**

The following threatened fauna species listed on the *Environmental and Biodiversity Conservation Act 1999* and the *Tasmanian Threatened Species Protection Act 1995* were recorded or have suitable habitat in the resource blocks:

#### **Grey Goshawk**

No suitable blackwood or riparian habitat occurs within the drilling area. Potential habitat is marginal and restricted to Andersons Creek and an un named class 4 stream outside of the drilling area. All stream side habitat will be buffered by 10 m (class 4) or 20 m (class 2 and 3).

#### **Masked owl**

No masked owls were observed during call back survey in 2007. Trees with suitable hollows exist in the study area. All trees with large main stem hollows will be avoided during the drilling program.

#### **Wedge-tailed Eagle**

Although no eagle nests were recorded during survey and none are anticipated to occur. A number of nests are known from the Dazzler Range in suitably protected habitat. As such it is unlikely that eagles would nest in the sub prime habitat of the Mt Vulcan sites. Nevertheless, all old growth trees will be avoided and all trees that are felled will be inspected for nests before felling and retained if nests are found.

#### **Eastern barred bandicoot**

No significant or direct impact is anticipated on this species. Suitable small grassy areas tend to occur on serpentinite outcrops. However, these are not the target of drilling and are outside of the drilling area.

#### **Spotted-tailed quoll**

There will be no significant impact on spotted-tailed quoll. The resource blocks do not support good quality den habitat. There are no suitable rocky outcrops, hollow logs are rare and do not make ideal defendable dens.

#### **Tasmanian devil**

There will be no significant impact on the Tasmanian devil. There are no suitable rocky outcrops, hollow logs are rare and do not make ideal defendable dens.

#### **Australian grayling and green and gold frog**

Andersons Creek supports potential habitat for the grayling. There are very limited locations of potential green and gold frog habitat at the margins of the drilling area. All standing water and streams will be avoided and drainage into all streams will be protected by 10 m buffers. Andersons creek will be buffered by 20 m if drilling occurs nearby.

#### **Weeds and *Phytophthora cinnamomi***

Spanish heath, gorse and *Pinus radiata* occur adjacent to two tracks at Mt Vulcan. The *P. radiata* are at the sites of past settlements. The spanish heath should be controlled before any work proceeds.

*Phytophthora cinnamomi* has been isolated from the serpentine soils south of the Mt Vulcan resource block but has not caused an epidemic of disease. Field observations

suggest that the saprolite soils may be suppressive to disease in species other than *X. australis*.

A strategy to reduce the risk of introduction and spread of *Phytophthora cinnamomi* has been developed. The strategy is based on standard PC hygiene protocols, exclusion of known and symptomatic infection sites, drilling areas free of PC first and disturbed areas and areas at highest risk of already supporting PC last.

### **Legislative Implications**

#### ***Environmental and Biodiversity Conservation Act 1999.***

Referral under the EPBC Act is necessary for any significant impact on any Matter of National Environmental Significance. The original drilling program was referred to the Commonwealth in 2008. In light of the very minor changes to the program no new referral is recommended.

#### ***Tasmanian Threatened Species Protection Act 1995.***

Five threatened flora species listed on this Act were recorded in the study area. A permit will be required to disturb *E. virgata* which is the only one of the five species found to occur in the drilling area.

#### ***Tasmanian Weed Management Act 2002***

Spanish Heath and gorse are Declared weeds. These species must be prevented from spreading to habitats of threatened species and communities.

The eradication of spanish heath and gorse is achievable from the Mt Vulcan resource block.

### **Recommendations**

1. Minimise the potential for impact on threatened flora and fauna habitat values:
  - a. Avoid *Epacris virgata* to the extent possible.
  - b. Avoid old growth trees (trees with hollows).
  - c. Do not enter within 10 m of class 4 streams and 20 m of Andersons Creek.
2. Implement the *Phytophthora cinnamomi* risk management strategy.
3. Eradicate spanish heath and gorse from the Mt Vulcan resource block.
  - a. Determine if the *Pinus radiata* have significant cultural value.
  - b. If not remove the pines from the Mt Vulcan resource block .

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## APPENDIX 1: DEFINITIONS OF SPECIES CONSERVATION VALUES

### SPECIES OF NATIONAL SIGNIFICANCE

#### Listed in Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

The *EPBC Act* has six categories of threat status for species:

1. **Extinct** - If at a particular time there is no reasonable doubt that the last member of the species has died
2. **Extinct in the wild** - If it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or If it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form
3. **Critically endangered** - If at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria
4. **Endangered** - If it is not critically endangered; and it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria
5. **Vulnerable** - If at a particular time it is not critically endangered or endangered; and it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
6. **Conservation dependent** - If, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years

### SPECIES OF STATE SIGNIFICANCE

#### Listed in Tasmanian *Threatened Species Protection Act 1995 (TSP Act)*

Threatened flora and fauna species in Tasmania are listed in Schedules 3 (extinct or endangered), 4 (vulnerable) or 5 (rare). These three categories are defined in Section 15 of the Act.

1. **Extinct** - If no occurrence of the taxon in the wild can be confirmed during the past 50 years
2. **Endangered** - If it is in danger of extinction because long-term survival is unlikely while the factors causing it to be endangered continue operating.
3. **Vulnerable** - If it is likely to become an endangered taxon while the factors causing it to be vulnerable continue operating.
4. **Rare** - If it has a small population in Tasmania that is not endangered or vulnerable but is at risk."

Species that have been nominated and approved by the Scientific Advisory Committee for listing in the Act

### SPECIES OF REGIONAL OR GENERAL SIGNIFICANCE

The following definitions are from three publications: Flora Advisory Committee 1994, Vertebrate Advisory Committee 1994, Invertebrate Advisory Committee 1994

Flora only - Species listed as rare but not necessarily 'at risk' (**r3**)

Fauna only – Species requiring monitoring (**m**)

Both – Species of unknown risk status (**k**) in Tasmania, or thought to be uncommon within region, or a species having a declining range or populations within the area.

Species considered to be outside its normal range or of an unusual form as determined and justified in the body of the report.

Species identified in regional studies as being of conservation significance that are not listed in current legislation

Species that have been recognised but have not been formally described in a published journal that are thought to be significant as determined and justified in the body of the report.

Plant species that are not known to be reserved. To be so it must be known to exist in at least one secure Reserve. Secure reserves include reserves and parks requiring the approval of both Houses of Parliament for their revocation. They include: National Parks, Aboriginal Sites, Historic Sites, Nature Reserves, State Reserves, Game Reserves, Forest Reserves, Wellington Park, and insecure reserves in the World Heritage Area which is protected by international agreement under the World Heritage Convention.

## **APPENDIX 2: LEGISLATIVE IMPLICATIONS OF THREATENED SPECIES**

### **TASMANIAN STATE LEGISLATION AFFECTING THREATENED SPECIES**

#### **Threatened Species Protection Act 1995**

Threatened flora and fauna species in Tasmania are listed in Schedules 3 (endangered) and 4 (vulnerable) of the Threatened Species Protection Act, 1995. Rare species that are considered to be 'at risk' are listed in Schedule 5 of the Act. These three categories are defined in Section 15 of the Act.

1. "An extant taxon of native flora or fauna may be listed as **endangered** if it is in danger of extinction because long-term survival is unlikely while the factors causing it to be endangered continue operating.
2. A taxon of native flora or fauna may be listed as **vulnerable** if it is likely to become an endangered taxon while the factors causing it to be vulnerable continue operating.
3. A taxon of native flora or fauna may be listed as **rare** if it has a small population in Tasmania that is not endangered or vulnerable but is at risk."

Section 51 (a) of the TSPA states that: "A person must not knowingly, without a permit - take, trade in, keep or process any listed flora or fauna". The Act defines 'take' as including: "kill, injure, catch, damage, destroy and collect. A land manager is therefore required to obtain a permit from the Tasmanian Department of Primary Industries and Water (DPIW) to carry out management that may adversely affect any of the species listed in the Act

## Commonwealth of Australia Legislation Affecting Threatened Species

### Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act establishes a process for assessing actions that are likely to have impacts of *national environmental significance*. Such impacts include World Heritage Areas, RAMSAR Wetland sites of international importance, migratory species protected under international agreements, nuclear actions, the Commonwealth marine environment and **nationally threatened species and communities**.

Threatened species are defined in several categories:

#### 1. Extinct

- If at a particular time there is no reasonable doubt that the last member of the species has died.

#### 2. Extinct in the wild

- If it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or
- If it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form

#### 3. Critically endangered

- If at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria

#### 4. Endangered

- If it is not critically endangered; and it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria

#### 5. Vulnerable

- If at a particular time it is not critically endangered or endangered; and it is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.

#### 6. Conservation dependent

- If, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years

An action that is likely to affect species that are listed in any of the above categories may require ministerial approval unless the Commonwealth Environment Minister has granted an exemption. The Act establishes a **referral process** to Environment Australia to determine whether an action requires a formal **approval** and thus would be required to proceed through the **assessment and approval process**.

A referral must provide sufficient information to allow the Minister to make a decision. The Minister is then required to make a decision within 20 business days of the referral. The Minister may decide an approval is not necessary if the action is taken in a specified manner. The action may not require approval but may require a **permit** if undertaken on Commonwealth land. If an approval is required then an **environmental assessment** must be carried out. In such instances the environmental assessment approach will be determined by the Minister and may vary from preliminary documentation to a full public inquiry depending on the scale and complexity of the impact.

**APPENDIX 3: FLORA SPECIES LISTS****Status codes:**

ORIGIN	NATIONAL SCHEDULE	STATE SCHEDULE
i - introduced	EPBC Act 1999	TSP Act 1995
d - declared weed WM Act	CR - critically endangered	e - endangered
en - endemic to Tasmania	EN - endangered	v - vulnerable
t - within Australia, occurs only in Tas.	VU - vulnerable	r - rare

Name	Common name	Status
<b>DICOTYLEDONAE</b>		
<b>APIACEAE</b>		
<i>Hydrocotyle hirta</i>	hairy pennywort	
<i>Hydrocotyle sp.</i>	pennywort	
<i>Xanthosia pilosa</i>	woolly crossherb	
<i>Xanthosia tasmanica</i>	small crossherb	
<b>ASTERACEAE</b>		
<i>Argentipallium dealbatum</i>	white everlasting	
<i>Brachyscome sp.</i>	daisy	
<i>Brachyscome spathulata</i>	spoonleaf daisy	
<i>Cassinia aculeata</i>	dollybush	
<i>Cirsium vulgare</i>	spear thistle	i
<i>Coronidium scorpioides</i>	curling everlasting	
<i>Cotula sp.</i>	buttons	
<i>Euchiton collinus</i>	common cottonleaf	
<i>Euchiton sp.</i>	cudweed	
<i>Hypochoeris radicata</i>	rough catsear	i
<i>Lagenophora sp.</i>	daisy	
<i>Lagenophora stipitata</i>	blue bottledaisy	
<i>Leontodon taraxacoides subsp. taraxacoides</i>	hairy hawkbit	i
<i>Leptinella longipes</i>	coast buttons	
<i>Olearia lirata</i>	forest daisybush	
<i>Olearia persoonioides</i>	geebung daisybush	en
<i>Senecio sp.</i>	groundsel	
<b>ATHEROSPERMATACEAE</b>		
<i>Atherosperma moschatum subsp. moschatum</i>	sassafras	

**CAMPANULACEAE**

<i>Pratia pedunculata</i>	matted pratia	
<i>Wahlenbergia</i> sp.	bluebell	

**CARYOPHYLLACEAE**

<i>Cerastium fontanum</i> subsp. <i>vulgare</i>	common mouse-ear	i
<i>Cerastium glomeratum</i>	sticky mouse-ear	i
<i>Cerastium</i> sp.	mouse-ear chickweed	i
<i>Stellaria pungens</i>	prickly starwort	

**CASUARINACEAE**

<i>Allocasuarina littoralis</i>	black sheoak	
<i>Allocasuarina monilifera</i>	necklace sheoak	en
<i>Allocasuarina verticillata</i>	drooping sheoak	

**CLUSIACEAE**

<i>Hypericum gramineum</i>	small st johns-wort	
<i>Hypericum japonicum</i>	matted st johns-wort	

**CONVOLVULACEAE**

<i>Dichondra repens</i>	kidneyweed	
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**CUNONIACEAE**

<i>Bauera rubioides</i>	wiry bauera	
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**DILLENIAACEAE**

<i>Hibbertia procumbens</i>	spreading guineaflower	
<i>Hibbertia prostrata</i>	prostrate guineaflower	
<i>Hibbertia riparia</i>	erect guineaflower	

**DROSERACEAE**

<i>Drosera peltata</i>	pale sundew	
<i>Drosera peltata</i> subsp. <i>auriculata</i>	tall sundew	
<i>Drosera pygmaea</i>	dwarf sundew	

**EPACRIDACEAE**

<i>Acrotriche serrulata</i>	ants delight	
<i>Astroloma humifusum</i>	native cranberry	
<i>Epacris impressa</i>	common heath	
<i>Epacris virgata</i>	pretty heath	en EN v
<i>Leucopogon australis</i>	spike beardheath	

<i>Leucopogon ericoides</i>	pink beardheath	
<i>Leucopogon sp.</i>	beard-heath	
<i>Lissanthe strigosa</i>	peach berry	
<i>Monotoca glauca</i>	goldey wood	
<b>ERICACEAE</b>		
<i>Erica lusitanica</i>	spanish heath	d
<b>EUPHORBIACEAE</b>		
<i>Amperea xiphoclada var. xiphoclada</i>	broom spurge	
<i>Poranthera microphylla</i>	small poranthera	
<b>FABACEAE</b>		
<i>Aotus ericoides</i>	golden pea	
<i>Bossiaea cordigera</i>	wiry bossia	
<i>Bossiaea prostrata</i>	creeping bossia	
<i>Daviesia ulicifolia</i>	spiky bitterpea	
<i>Dillwynia sericea</i>	showy parrotpea	
<i>Goodia lotifolia</i>	clovertree, golden tip	
<i>Hovea heterophylla</i>	winter purplepea	
<i>Indigofera australis</i>	native indigo	
<i>Pultenaea daphnoides var. obcordata</i>	heartleaf bushpea	
<i>Pultenaea dentata</i>	swamp bushpea	
<i>Pultenaea gunnii</i>	golden bushpea	
<i>Trifolium sp.</i>	clover	
<i>Ulex europaeus</i>	gorse	d
<b>GENTIANACEAE</b>		
<i>Centaurium erythraea</i>	common centaury	i
<b>GERANIACEAE</b>		
<i>Geranium potentilloides</i>	mountain cranesbill	
<i>Geranium sp.</i>	native geranium	
<i>Pelargonium sp.</i>	stork's-bill	
<b>GOODENIACEAE</b>		
<i>Dampiera stricta</i>	blue dampiera	
<i>Goodenia lanata</i>	trailing native-primrose	
<b>HALORAGACEAE</b>		
<i>Gonocarpus tetragynus</i>	common raspwort	

<i>Gonocarpus teucroides</i>	forest raspwort	
<i>Myriophyllum sp.</i>	water milfoil	
<b>LAMIACEAE</b>		
<i>Prostanthera lasianthos var. lasianthos</i>	christmas mintbush	
<i>Prunella vulgaris</i>	selfheal	i
<b>LAURACEAE</b>		
<i>Cassytha glabella</i>	slender dodderlaurel	
<i>Cassytha pubescens</i>	downy dodderlaurel	
<b>MIMOSACEAE</b>		
<i>Acacia dealbata subsp. dealbata</i>	silver wattle	
<i>Acacia genistifolia</i>	spreading wattle	
<i>Acacia mearnsii</i>	black wattle	
<i>Acacia melanoxydon</i>	blackwood	
<i>Acacia mucronata</i>	variable sallow wattle	
<i>Acacia myrtifolia</i>	redstem wattle	
<i>Acacia terminalis</i>	sunshine wattle	
<i>Acacia verticillata</i>	prickly mimosa	
<b>MYRTACEAE</b>		
<i>Baeckea ramossisima</i>		
<i>Callistemon pallidus</i>	yellow bottlebrush	
<i>Callistemon viridiflorus</i>	prickly bottlebrush	en
<i>Eucalyptus amygdalina</i>	black peppermint	en
<i>Eucalyptus globulus subsp. globulus</i>	tasmanian blue gum	
<i>Eucalyptus obliqua</i>	stringybark	
<i>Eucalyptus ovata var. ovata</i>	black gum	
	<i>Eucalyptus viminalis subsp. viminalis</i>	white gum
<i>Euryomyrtus ramosissima</i>	heath-myrtle	
<i>Kunzea ambigua</i>	white kunzea	
<i>Leptospermum lanigerum</i>	woolly teatree	
<i>Leptospermum scoparium</i>	common tea-tree	
<i>Melaleuca ericifolia</i>	coast paperbark	
<i>Melaleuca squamea</i>	swamp honeymyrtle	
<i>Melaleuca squarrosa</i>	scented paperbark	
<b>OLEACEAE</b>		
<i>Notelaea ligustrina</i>	native olive	

**ONAGRACEAE**

*Epilobium* sp. willowherb

**OXALIDACEAE**

*Oxalis perennans* grassland woodsorrel

**PITTOSPORACEAE**

*Billardiera longiflora* purple appleberry en

*Billardiera mutabilis* green appleberry

*Bursaria spinosa* subsp. *spinosa* prickly box

*Pittosporum bicolor* cheesewood

*Rhytidosporum procumbens* starry appleberry

**PLANTAGINACEAE**

*Plantago varia* variable plantain

**POLYGALACEAE**

*Comesperma volubile* blue lovecreeper

**POLYGONACEAE**

*Acetosella vulgaris* sheep sorrel i

**PROTEACEAE**

*Banksia marginata* silver banksia

*Hakea epiglottis* beaked hakea en

*Lomatia tinctoria* guitarplant en

*Persoonia juniperina* prickly geebung

**RANUNCULACEAE**

*Clematis aristata* mountain clematis

*Ranunculus* sp. buttercup

**RHAMNACEAE**

*Pomaderris apetala* common dogwood

*Pomaderris elliptica* yellow dogwood

*Pomaderris pilifera* hairy dogwood

*Pomaderris racemosa* slender dogwood

*Spyridium obcordatum* creeping dustymiller en VU v

**ROSACEAE**

*Acaena novae-zelandiae* common buzzy

<i>Acaena</i> sp.	sheep's burr	
<i>Rubus gunnianus</i>	alpine raspberry	en
<i>Rubus parvifolius</i>	native raspberry	
<b>RUBIACEAE</b>		
<i>Asperula conferta</i>	common woodruff	
<i>Coprosma hirtella</i>	coffeeberry	
<i>Coprosma quadrifida</i>	native currant	
<i>Galium australe</i>	tangled bedstraw	
<b>RUTACEAE</b>		
<i>Correa lawrenceana</i> var. <i>lawrenceana</i>	mountain correa	en
<i>Correa reflexa</i>	correa	
<i>Zieria arborescens</i>	stinkwood	
<b>SANTALACEAE</b>		
<i>Exocarpos cupressiformis</i>	common native-cherry	
<i>Exocarpos strictus</i>	pearly native-cherry	
<i>Leptomeria drupacea</i>	erect currantbush	
<b>SCROPHULARIACEAE</b>		
<i>Veronica calycina</i>	hairy speedwell	
<b>STACKHOUSIACEAE</b>		
<i>Stackhousia monogyna</i>	forest candles	
<b>STYLIDIACEAE</b>		
<i>Stylidium graminifolium</i>	narrowleaf triggerplant	
<b>THYMELAEACEAE</b>		
<i>Pimelea curviflora</i>	curved riceflower	
<i>Pimelea drupacea</i>	cherry riceflower	
<i>Pimelea glauca</i>	smooth riceflower	
<i>Pimelea humilis</i>	dwarf riceflower	
<i>Pimelea linifolia</i> subsp. <i>linifolia</i>	slender riceflower	
<i>Pimelea linifolia</i> subsp. <i>linoides</i>	greater slender riceflower	
<i>Pimelea nivea</i>	bushmans bootlace	en
<i>Pimelea</i> sp.	riceflower	
<b>TREMANDRACEAE</b>		
<i>Tetratheca pilosa</i>	hairy pinkbells	

**URTICACEAE**

*Urtica incisa* scrub nettle

**VIOLACEAE**

*Viola arvensis* field pansy i

*Viola betonicifolia subsp. betonicifolia* showy violet

*Viola cleistogamoides* shy violet

*Viola hederacea* ivyleaf violet

**WINTERACEAE**

*Tasmania lanceolata* mountain pepper

**MONOCOTYLEDONAE****CENTROLEPIDACEAE**

*Centrolepis strigosa* hairy centrolepis, bristlewort

**CYPERACEAE**

*Carex inversa* knob sedge

*Gahnia grandis* cutting grass

*Gahnia radula* thatch sawsedge

*Gahnia rodwayi* dwarf sawsedge en

*Gahnia sieberiana* redfruit sawsedge

*Gahnia sp.* saw-sedge

*Isolepis sp.* club rush

*Lepidosperma concavum* sand swordsedg

*Lepidosperma elatius* tall swordsedg

*Lepidosperma ensiforme* arching swordsedg

*Lepidosperma filiforme* common rapiersedg

*Lepidosperma gunnii* narrow swordsedg

*Lepidosperma inops* fan sedge en

*Lepidosperma laterale* variable swordsedg

*Lepidosperma longitudinale* spreading swordsedg

*Schoenus apogon* common bogsedg

*Schoenus sp.* bogsedg

*Tetraria capillaris* hair sedge

**IRIDACEAE**

*Diplarrena moraea* white flag-iris

*Patersonia fragilis* short purpleflag

**JUNCACEAE**

<i>Juncus bassianus</i>	forest rush
<i>Juncus pallidus</i>	pale rush
<i>Juncus pauciflorus</i>	looseflower rush
<i>Juncus planifolius</i>	broadleaf rush
<i>Juncus sp.</i>	Rush
<i>Luzula flaccida</i>	pale woodrush

**LILIACEAE**

<i>Arthropodium milleflorum</i>	pale vanilla-lily
<i>Burchardia umbellata</i>	milkmaids
<i>Dianella tasmanica</i>	forest flaxlily
<i>Drymophila cyanocarpa</i>	turquoise berry
<i>Wurmbea dioica subsp. dioica</i>	early nancy

**ORCHIDACEAE**

<i>Acianthus caudatus</i>	mayfly orchid	
<i>Acianthus sp.</i>	mosquito orchid	
<i>Caladenia carnea</i>	pink fingers	
<i>Caladenia sp.</i>	spider-orchid	
<i>Chiloglottis gunnii</i>	tall bird-orchid	en
<i>Chiloglottis sp.</i>	bird orchid	
<i>Chiloglottis triceratops</i>	threehorned bird-orchid	
<i>Cyrtostylis reniformis</i>	small gnat-orchid	
<i>Diuris sulphurea</i>	tiger orchid	
<i>Glossodia major</i>	waxlip orchid	
<i>Pterostylis nutans</i>	nodding greenhood	
<i>Pterostylis pedunculata</i>	maroonhood	
<i>Pterostylis sp.</i>	greenhood	
<i>Thelymitra aristata</i>	great sun-orchid	
<i>Thelymitra rubra</i>	pink sun-orchid	
<i>Thelymitra sp.</i>	sun-orchid	

**POACEAE**

<i>Agrostis sp.</i>	blown grass	
<i>Aira caryophyllea</i>	silvery hairgrass	i
<i>Austrodanthonia sp.</i>	wallabygrass	
<i>Austrostipa aphylla</i>	leafless speargrass	en
<i>Austrostipa stipoides</i>	coast speargrass	
<i>Ehrharta distichophylla</i>	hairy ricegrass	

<i>Ehrharta</i> sp.	ricegrass	
<i>Ehrharta stipoides</i>	weeping grass	
<i>Lachnagrostis</i> sp.	blown grass	
<i>Poa annua</i>	winter grass	i
<i>Poa gunnii</i>	gunns snowgrass	en
<i>Poa rodwayi</i>	velvet tussockgrass	
<i>Poa sieberiana</i>	grey tussockgrass	
<i>Poa</i> sp.	poa	

**RESTIONACEAE**

<i>Calorophus elongatus</i>	long roperush	
<i>Empodisma minus</i>	spreading roperush	
<i>Eurychorda complanata</i>	flat cordrush	
<i>Leptocarpus tenax</i>	slender twinerush	

**XANTHORRHOEACEAE**

<i>Lomandra longifolia</i>	sagg	
<i>Xanthorrhoea australis</i>	southern grasstree	

**PTERIDOPHYTA**

**ADIANTACEAE**

<i>Adiantum aethiopicum</i>	common maidenhair	
<i>Cheilanthes austrotenuifolia</i>	green rockfern	

**ASPIDIACEAE**

<i>Polystichum proliferum</i>	mother shieldfern	
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**ASPLENIACEAE**

<i>Asplenium bulbiferum</i> subsp. <i>gracillimum</i>	mother spleenwort	
<i>Asplenium flabellifolium</i>	necklace fern	

**BLECHNACEAE**

<i>Blechnum nudum</i>	fishbone waterfern	
<i>Blechnum watsii</i>	hard waterfern	

**CYATHEACEAE**

<i>Cyathea australis</i> subsp. <i>australis</i>	rough treefern	
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**DENNSTAEDTIACEAE**

<i>Histiopteris incisa</i>	batswing fern	
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*Hypolepis rugosula* ruddy groundfern  
*Pteridium esculentum* bracken

**DICKSONIACEAE**

*Calochlaena dubia* rainbow fern  
*Dicksonia antarctica* soft treefern

**GLEICHENIACEAE**

*Gleichenia dicarpa* pouched coralfern  
*Gleichenia microphylla* scrambling coralfern  
*Sticherus tener* silky fanfern

**LINDSAEACEAE**

*Lindsaea linearis* screw fern

**LYCOPODIACEAE**

*Lycopodiella* sp. clubmoss  
*Lycopodium deuterodensum* conifer clubmoss

**OSMUNDACEAE**

*Todea barbara* southern kingfern

**PTERIDACEAE**

*Pteris comans* netted brake

**SELAGINELLACEAE**

*Selaginella uliginosa* swamp spikemoss