



Construction of Mountain Bike Trails

Cruiser Beginner Trail & Parks

DA 22/9799

Detailed Rehabilitation and Monitoring Plan



Department of Planning
and Environment

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Signed E Liang

Sheet No 5 of 6

Table of Contents

1	Introduction	1
1.1	Aims and Objectives.....	1
2	Rehabilitation Program	1
2.1	Rehabilitation Areas.....	1
2.2	Rehabilitation and Stabilisation	1
2.3	Transplanting of <i>Ranunculus anemoneus</i>	5
2.4	Trail Hardening.....	6
2.5	Monitoring	6
2.6	Schedule.....	7
2.7	Maintenance & Mitigation.....	8
3	Exotic Species.....	10
4	Appendices.....	11
4.1	Appendix 1 – Development Area Map.....	12
4.2	Appendix 2 – Rehabilitation Species.....	13

1 Introduction

This rehabilitation and monitoring plan has been prepared to detail the rehabilitation required for all areas disturbed by the construction works associated with the development. The rehabilitation activities consist of trail verge stabilisation and revegetation works.

1.1 Aims and Objectives

The aim of this plan is to achieve successful rehabilitation of all areas disturbed by the works (excluding the trail tread) with full vegetation coverage to achieve an erosion resistant state. The objectives of this rehabilitation plan are:

- Detail the rehabilitation works required by the proposal for all disturbed areas;
- Set out the schedule for the rehabilitation activities;
- Provide information on plant species and planting ratios; and
- Dictate the maintenance and monitoring of the disturbed and rehabilitation areas.

2 Rehabilitation Program

2.1 Rehabilitation Areas

The areas to be rehabilitated consist of all areas disturbed as a component of the works (excluding the trail tread). These areas include the verges of the completed trail, jumps line and skills park and any disturbed areas adjacent to the works. The development areas are shown in Appendix 1.

2.2 Rehabilitation and Stabilisation

The rehabilitation and stabilisation works will be consistent with the Rehabilitation Guidelines for the Resort Areas of Kosciuszko National Park (NPWS). The works are to be carried out by Kosciuszko Thredbo Pty Ltd (KT) staff or suitable contractor on KT's behalf. Methods will consist of:

Timing	Procedure	Methods
Pre-construction	Establish construction corridor & trail alignment	<ul style="list-style-type: none">• Flag trail alignment using pin flags and flagging tape• Mark out construction corridor to prevent damage to adjacent areas
	Treatment of weeds	<ul style="list-style-type: none">• Treat weeds within disturbance area to ensure they are not spread further using methods relevant to the weed species being treated
	Identify trees to be removed	<ul style="list-style-type: none">• Clearly identify any trees to be removed with flagging tape and inspect for nests / fauna• Alignment of trail is to avoid clearance of mature canopy vegetation
	Implement Site Environmental Management Measures	<ul style="list-style-type: none">• Erosion & sediment controls to be put in place prior to construction where possible and during construction
	Cleaning of machinery	<ul style="list-style-type: none">• Ensure all machinery to be used on construction site is cleaned at wash down bay to prevent spread of weed species in resort

	Identify "No Go" areas	<ul style="list-style-type: none"> Identify & mark "No Go" areas to clearly delineate sensitive areas to be avoided
	Identify <i>Podocarpus lawrencei</i> (Mountain Plum Pine)	<ul style="list-style-type: none"> Identify and mark out <i>Podocarpus lawrencei</i> Alignment of trail is to avoid <i>Podocarpus lawrencei</i> Ensure KT staff/contractors are able to accurately identify
	Identify <i>Ranunculus anemoneus</i> (Anemone Buttercup)	<ul style="list-style-type: none"> Identify and mark out <i>Ranunculus anemoneus</i> in order to minimise and mitigate impacts during construction works Alignment of trail is to avoid <i>Ranunculus anemoneus</i> Ensure KT staff/contractors are able to accurately identify Environmental Officer to GPS record location of <i>Ranunculus anemoneus</i> for on-going monitoring
	Identify set down and stockpile areas	<ul style="list-style-type: none"> Identify and mark out appropriate plant & equipment set down areas for short term placement of machinery & materials avoiding areas of native vegetation Set down areas are to be located within trail construction zone, identified stockpile site or site compound only and strictly adhered to
	Identify wombat burrows	<ul style="list-style-type: none"> Identify and mark out wombat burrows within the construction corridor Trail alignment is to avoid wombat burrows
During Construction	Minimise disturbance & stay within trail corridor	<ul style="list-style-type: none"> Minimise disturbance to adjacent native vegetation Limit movement of construction equipment to construction area and nominated set down areas
	Transplant <i>Ranunculus anemoneus</i> (Anemone Buttercup) if required	<ul style="list-style-type: none"> If <i>Ranunculus anemoneus</i> is discovered on the trail alignment during the course of construction that has not been previously identified, Environmental Officer is to be contacted immediately and works are to cease in that area Environmental Officer and trails supervisor to determine if trail alignment can be moved within the flexible construction corridor of 20m (10m either side of the ground-truthed alignment) to avoid If trail alignment is unable to be altered, <i>Ranunculus anemoneus</i> is to be transplanted as per Section 2.3 of this rehabilitation plan
	Regularly maintain site environmental management measures	<ul style="list-style-type: none"> Conduct regular inspections and maintenance of sediment and erosion controls
	Sod cutting, collection & storage (as per Rehabilitation Guidelines for the Resort Areas of KNP)	<ul style="list-style-type: none"> Native forbs and grasses are the most appropriate for sodding Where sod collection is possible, cut sods to a depth of 10-20cm (leaving a layer of intact topsoil underneath) and to a size of 30cm² Store sods collected on geofabric adjacent to the construction area

		<ul style="list-style-type: none"> Sod storage time to be kept to a minimum and sods to be utilised as soon as possible after cutting and storage Monitor sods and environmental conditions and water if necessary
	Soil removal	<ul style="list-style-type: none"> Place topsoil & subsoil separately Adhere to Soil Stockpile Guidelines for Resort Areas of KNP
	Soil replacement	<ul style="list-style-type: none"> All excess soil gained from trail construction works is to be spread over the disturbed areas prior to rehabilitation Ensure subsoil and topsoil are replaced in correct order
	Spread excess vegetation	<ul style="list-style-type: none"> All excess native vegetation to be dispersed on exposed soil along the trail edge, placed on batters & embankments for erosion control or carefully spread further into bushland to avoid smothering of understory vegetation communities Any excess thatch unable to be used for the above is to be stockpiled off-site for use on other rehabilitation projects with the resort
	Management of ephemeral springs crossing marked trail alignment	<ul style="list-style-type: none"> Manage water from ephemeral springs with the installation of rock armouring and/or construction of rock stormwater pits and piping of water underneath trail Drainage pipe to discharge into rock dispersion pits to reduce water velocity and erosion
Post Construction	Direct seeding	<ul style="list-style-type: none"> Areas of open ski slope adjacent to the trail tread and dominated by EXOTIC grasses, seed using a 1:1 mix of Chewings fescue & <i>Poa fawcettiae</i> Areas of open ski slope adjacent to the trail tread and dominated by NATIVE species, use only 100% native <i>Poa</i> endemic to the area Seeding rate: Slope grade <40% use 15-20g/m² Slope grade >40% use 20-30g/m² Broadcast Dynamic Lifter @ 100g/m² Weed free rice straw mulch and jute mesh to be applied over seed to protect soil and provide a favourable environment for establishment
	Sod replacement	<ul style="list-style-type: none"> Utilise sod replacement in disturbed areas where possible particularly in areas of native vegetation in accordance with "Rehabilitation Guidelines for the Resort Areas of KNP" – Section C.1.4
	Stabilise disturbed areas (batters/embankments)	<ul style="list-style-type: none"> Spread weed free rice straw on slope grades <40% @ 1 bale per 25m² and weigh down using native thatch / litter gained from works. Jute mesh may be used if thatch amount insufficient Install Jute mesh (or similar) over straw on batters & embankments >500mm height & with a slope >40% (Grade% = Rise/Run x 100) Direct seed at rates listed above to stabilise disturbed areas including batters & embankments

	Planting native tube stock	<ul style="list-style-type: none"> • Plant tube stock on batters & embankments in areas of native vegetation • Plant shrubs at 3/m² • Plant grasses and forbs at 5/m² • Refer to Appendix 2 for suitable rehabilitation species • Water crystals & organic fertiliser may be used at label rates • <i>Water crystals</i>: 5gm pre-hydrated crystals, crystals must be hydrated for at least 2hrs prior to planting • <i>Fertiliser</i>: 1 x Typhoon Native fertiliser tablet per plant (<i>Poa</i> & shrubs) placed next to or below roots
	Watering	<ul style="list-style-type: none"> • If required, water rehabilitation areas to assist in seed germination, tubestock establishment and straw retention
	Weed control	<ul style="list-style-type: none"> • Monitor all areas disturbed by the works (including areas adjacent to the works) for signs of weed infestation • Treat weeds with methods appropriate to weed species being treated including low pressure spot spraying and hand removal techniques • Limit off-target damage by only spraying in the appropriate conditions • Weed monitoring & control is to be conducted on an on-going basis and included in annual resort weed control activities

2.3 Transplanting of *Ranunculus anemoneus*

In order to minimise and mitigate the impacts to *Ranunculus anemoneus* (Anemone Buttercup) that may be caused by the construction works, trail alignment is to avoid *Ranunculus anemoneus* in the first instance. During the course of construction, if *Ranunculus anemoneus* is discovered on the trail alignment that has not been previously identified the Environmental Officer is to be contacted immediately and works are to cease in that area. The Environmental Officer and trails supervisor are to determine if trail alignment can be moved within the flexible construction corridor of 20m (10m either side of the ground-truthed alignment) to avoid. If the trail alignment is unable to be altered, *Ranunculus anemoneus* is to be transplanted as per the procedure below.

Procedure for transplanting:

- Identify and mark out plants that may be impacted by trail construction
- Select appropriate area for relocation including:
 - Similar altitude, aspect, soil type, hydrological regime and surrounding vegetation;
 - Location where tree guards can be installed and not impacted by winter operations;
 - Transplanting area is to be located as close as possible to current location and not on a ski run
- Water area around the plants to be moved
- Pre-dig new holes and water
- Using a very sharp spade do a cut around the plant to be transplanted to a depth of 400-500mm and at least 100-150mm from all leaf edges
- Excavate the plant as a block ensuring minimal root disturbance and place in a clean sterilised tub
- All the soil/peat around the roots must be retained as this has a suite of microbes the plants needs to access nutrients (transplant in the afternoon when cooler and not during the heat of the day to reduce stress on the plant)
- Transport plants immediately to new location
- Place plants in pre-dug holes that match the size of the soil block and water in to remove any air pockets around the roots
- Place weed-free rice straw mulch around the base of plants to protect exposed soil and help retain moisture
- Place mesh tree guards around plants to reduce the impacts of herbivore predation (tree guards are to be cable tied to stakes and the top of the tree guards closed)
- Maintenance watering of plants is to occur regularly and should be based on current climatic conditions until plants have re-established (soil around plants should be moist but not saturated)
- Monitor plants for signs of stress such as leaf wilting or discolouration which may indicate moisture or nutrient stress and rectify:
 - Moisture stress – water until surrounding soil is moist but not saturated
 - Nutrient stress – apply diluted Seasol liquid fertiliser at label rate of 30ml Seasol per 9L water to stimulate root growth and nutrient uptake (9L of diluted Seasol mixture will cover approximately 2 to 4m²)
- To reduce stress, transplant preferably during Autumn as plants are senescing and returning to dormancy
- Water regularly until snow has covered site
- Monitor and water plants for at least two seasons to aid success of transplanting

2.4 Trail Hardening

Trail hardening during and post construction will assist in reducing surface loss from the trail tread which in turn will reduce issues such as breaking bumps, exposed roots and sub-surface rock, water channelling and undercutting and sedimentation of drains, sumps and vegetation.

Trail hardening methods will include:

- Trail grading and compaction using excavator, manual hand tools and vibrating plate;
- Watering of trail tread to aid in compaction;
- Use of rock armouring and aggregate where required;
- Trail not to be used by the general public for a minimum of 30 days following completion;
- Approved KT staff to “ride-in” trail in a steady and controlled manner to aid compaction in the preferred ride line (ride-in staff to be approved at the Mountain Managers discretion).

2.5 Monitoring

Weekly inspections of the construction area will be carried out by the Environmental Officer during the construction phase as per the Site Environmental Management Plan (SEMP). These inspections are to ensure that all site environmental management measures are in place and in good working order. On-going monitoring will occur as per the Rehabilitation & Monitoring schedule.

2.6 Schedule

The initial rehabilitation and stabilisation works are to be carried out as a component of the construction works during the trail finishing/grooming phase. The maintenance works associated with the rehabilitation areas are to be undertaken on an on-going, as required basis throughout each summer season. The schedule for the rehabilitation works is provided in the table below. The appointed Environmental Officer for the project is responsible for ensuring that all preparation, works, monitoring and reporting are carried out to the required standard. The works will be carried out by KT staff or an appointed contractor.

Rehabilitation and monitoring schedule

AREA	PROCEDURE	TIMING
Trail verge Berms Batters Embankments	Site Preparation	During construction (Nov '22 to Apr '23)
	Transplanting of <i>Ranunculus anemoneus</i>	Prior to construction of trail in the vicinity of <i>Ranunculus anemoneus</i> (if required)
	Seeding and planting tube stock	During construction (Nov '22 to Apr '23) and ongoing annually until adequate groundcover has been achieved
	Mulching	During construction (Nov '22 to Apr '23) and ongoing annually until adequate groundcover has been achieved
	Maintenance (incl. weed control & replacement planting)	Ongoing annually as required (between November and May)
	Monitoring	<p>Weekly during construction as per SEMP</p> <p>Monthly post construction for the first 12 months to monitor for erosion, sediment control and plant establishment</p> <p>Annually once stabilisation has been achieved, between November & May each year up until the date 5 years after the issue of a final occupation certificate.</p> <p>At the completion of the 5 years general monitoring & maintenance will continue.</p> <p>Monitoring will be conducted by way of site inspection with triggers for action detailed in Section 2.7 - Maintenance & Mitigation</p>

2.7 Maintenance & Mitigation

In the event that monitoring indicates initial rehabilitation efforts are not effective (minimal grass / shrub establishment, establishment of weed species or declining coverage), additional management actions may be required. Management actions will be determined following 3 consecutive months of poor establishment or declining survival rates of native species planted. If deemed necessary, this period will be brought forward to implement the additional actions required. The management actions are to consist of one or more of the following:

Area	Maintenance trigger	Action
All areas disturbed by construction works	Poor grass & shrub establishment <75% native species coverage	<ul style="list-style-type: none"> • Additional direct seeding in areas of open non-native vegetation • In-fill planting of native tube stock • Grazing control by use of tree guards where appropriate
	Presence of weeds	<ul style="list-style-type: none"> • Weeds to be controlled annually include, but not limited to, Milfoil, St John's Wort, thistle & Juncus • Spot spray using low pressure sprayer • Use of hand removal techniques where appropriate
	Identification of erosion & unstable areas	<ul style="list-style-type: none"> • Installation of Jute mesh, brush matting & mulching • Installation of hay bale and sediment fencing control measures • Maintenance of sediment retention pits, water bars and drains • Carry out additional planting & re-vegetation works as per Rehabilitation table
	Presence of sediment & debris	<ul style="list-style-type: none"> • Remove build-up of sediment from sediment retention pits and pipe inlets & outlets as required • Removal of any excess sediment from vegetation adjacent to the trail
Drains Water bars Sediment retention pits	Presence of sediment & debris Identification of damage	<ul style="list-style-type: none"> • Inspection of drains, water bars & sediment retention pits particularly after heavy rainfall • Removal of sediment and debris to prevent blockages / overflow and limit sedimentation of vegetation • Regular inspection to identify damage to system and maintenance
Transplanted <i>Ranunculus anemoneus</i>	Leaf wilting	<ul style="list-style-type: none"> • May indicate moisture stress • Water plants to ensure soil is kept moist but not saturated • Ensure rice straw mulch is in place and apply more as required • Alter watering schedule around current climatic conditions • Keep area around plants weed-free by hand removal of weeds

	Yellowing or discolouration of leaves	<ul style="list-style-type: none"> • May indicate nutrient stress or deficiency • Apply diluted Seasol liquid fertiliser at the label rate for transplanting (30ml Seasol concentrate per 9L water) • Apply with watering can (9L will treat an area of 2 to 4m²) • Inspect plants 1 week after application and re-treat if necessary • Fertiliser is to be used with restraint
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Additional planting & re-vegetation works are to be carried out as per the Rehabilitation table. If it is found that after 12 months of monitoring the rehabilitation efforts are not effective, KT will liaise with NPWS to determine the most appropriate action. The 12-month period will allow time for the rehabilitation area to establish prior to any further intervention.

3 Exotic Species

All areas disturbed by the works are to be monitored on an ongoing basis for the occurrence of any exotic flora and evidence of exotic fauna (scats and tracks). In the event of the detection of exotic species, appropriate control works are to be scheduled as required as set out below.

Exotic flora

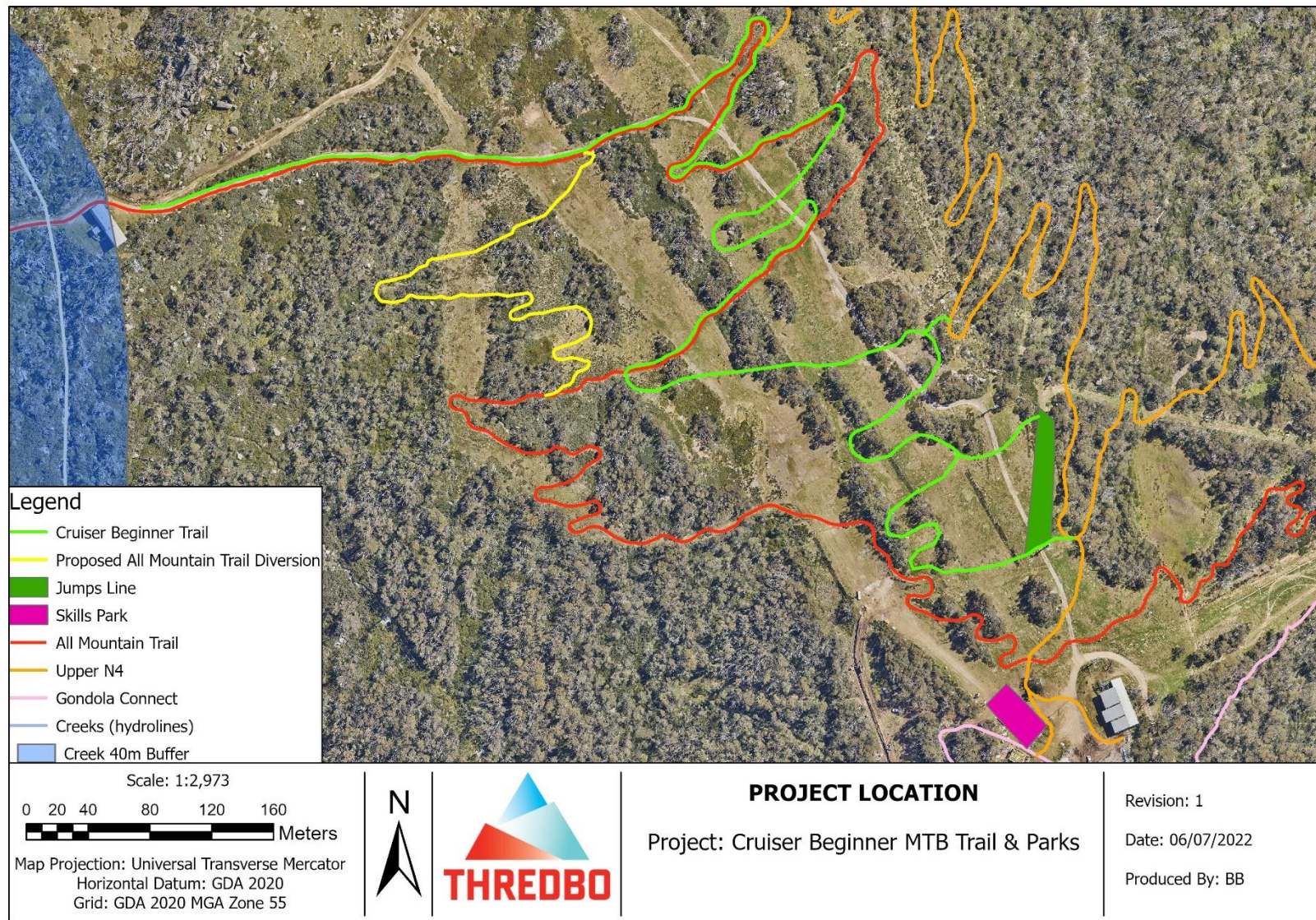
The control of exotic flora is to be undertaken using either spot spraying or hand removal techniques. The spraying activities are to be undertaken using appropriate herbicide for the species being treated and techniques for the conditions on the day. All control activities are to be undertaken prior to plant seed set.

Exotic fauna

The control of exotic fauna is to be undertaken in cooperation with NPWS as a resort wide program targeting the control of cats, foxes and rabbits. The cat and fox trapping program is undertaken by KT during the winter months in the village and on the lower slopes of the resort. Rabbit control programs are conducted in autumn and spring by KT staff also targeting these areas. Feral deer, cat, fox and dog control is undertaken by NPWS outside of the KT lease area.

4 Appendices

4.1 Appendix 1 – Development Area Map



4.2 Appendix 2 – Rehabilitation Species

The following species have been selected from the publication “Rehabilitation Guidelines for the Resort Areas of Kosciuszko National Park (NPWS 2007)” and also known to be present in the development area as per the Flora and Flora Assessment conducted by Ryan Smithers, Senior Ecologist, Eco Logical Australia. The table represents some of the recommended species for revegetation activities within Thredbo Resort at the development site altitude.

Rehabilitation Species – Thredbo Cruiser Area (1620m – 1870m)

Form	Species	Common Name
Forbs		
	<i>Acaena novae-zelandia</i>	Bidgee-widgee
	<i>Asperula gunnii</i>	Mountain Woodruff
	<i>Celmisia pugioniformis</i>	Dagger-leaf Celmisia
	<i>Leptorhynchus squamatus</i>	Scaly Buttons
	<i>Microseris lanceolata</i>	Native Dandelion
	<i>Senecio gunnii</i>	Gunn’s Groundsel
	<i>Stellaria pungens</i>	Starwort
Grasses		
	<i>Poa ensiformis</i>	Purple-sheathed Tussock-grass
	<i>Poa fawcettiae</i>	Smooth-blue Snow-grass
Shrubs		
	<i>Baeckea gunniana</i>	Alpine Baeckea
	<i>Bossiaea foliosa</i>	Small Leaved Bossiaea
	<i>Grevillea australis</i>	Alpine Grevillea
	<i>Hovea montana</i>	Alpine Hovea
	<i>Olearia phlogopappa</i>	Dusty Daisy-bush
	<i>Ozothamnus secundifloris</i>	Cascade Everlasting
	<i>Ozothamnus hookeri</i>	Kerosene Bush
	<i>Podocarpus lawrencei</i>	Mountain Plum-pine
	<i>Prostanthera cuneata</i>	Alpine Mint-bush
	<i>Tasmannia xerophila</i>	Alpine Pepper
Trees		
	<i>Eucalyptus pauciflora</i> subsp. <i>niphophila</i>	Snow Gum