



Construction of Mountain Bike Trails

Beginner MTB Trail & Skills Park

Detailed Rehabilitation and Monitoring Plan



Department of Planning
Housing and Infrastructure

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Signed Z Derbyshire

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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	Trail Hardening.....	4
2.4	Rehabilitation of closed trail alignment.....	4
2.5	Monitoring	5
2.6	Schedule.....	5
2.7	Maintenance & Mitigation.....	6
3	Exotic Species.....	7
4	Appendices.....	8
4.1	Appendix 1 – Development Area Map.....	9
4.2	Appendix 2 – Rehabilitation Species.....	10

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 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. These areas include the verges of the completed trail, skills park, existing trail that is to be closed 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
	Identify <i>Ranunculus anemoneus</i> (Anemone Buttercup)	<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, KT is to consult NPWS regarding most appropriate action
	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, or trail to be closed, 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, or trail to be closed, 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 and trail to be closed)	<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)

		<ul style="list-style-type: none"> • 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 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).

2.4 Rehabilitation of closed trail alignment

At the completion of the trail hardening period and once the new alignment is open, sections of trail to be closed are to be rehabilitated. Rehabilitation method is to consist of:

- “Scratch up” existing alignment with mini excavator to reduce compaction of trail tread, allow increased water infiltration and aid in plant and root establishment;
- Import topsoil from Thredbo stockpile site and place in areas of trail requiring topsoil;

- Lightly rake disturbed alignment cross-slope to form shallow furrows for seed. As fescue & *poa* seed is small, furrows should only be 1-2cm deep. Grass seed will not germinate if sown too deep;
- Apply dynamic lifter;
- Spread weed free rice straw on all exposed soil;
- Water in to prevent straw from blowing away and aid in seed germination;
- Seed, fertiliser and straw to be applied at rates listed in the Rehabilitation & Stabilisation table;
- Chewings fescue to only be used on areas of open ski slope dominated by exotic grasses;
- In areas of native vegetation, use only 100% native *Poa* endemic to the area and native shrubs as per Appendix 2 – Rehabilitation Species.

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 and closed trail rehabilitation 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	Site Preparation	During construction
Berms	Seeding and planting	During construction and ongoing annually until
Batters	tube stock	adequate groundcover has been achieved
Embankments	Mulching	During construction and ongoing annually until
Closed Trail section		adequate groundcover has been achieved
	Maintenance (incl. weed control & replacement planting)	Ongoing annually as required (between November and May)
	Monitoring	Weekly during construction as per SEMP Monthly post construction for the first 12 months to monitor for erosion, sediment control and plant establishment 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.

		At the completion of the 5 years general monitoring & maintenance will continue. Monitoring will be conducted by way of site inspection with triggers for action detailed in Section 2.6 - Maintenance & Mitigation
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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

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

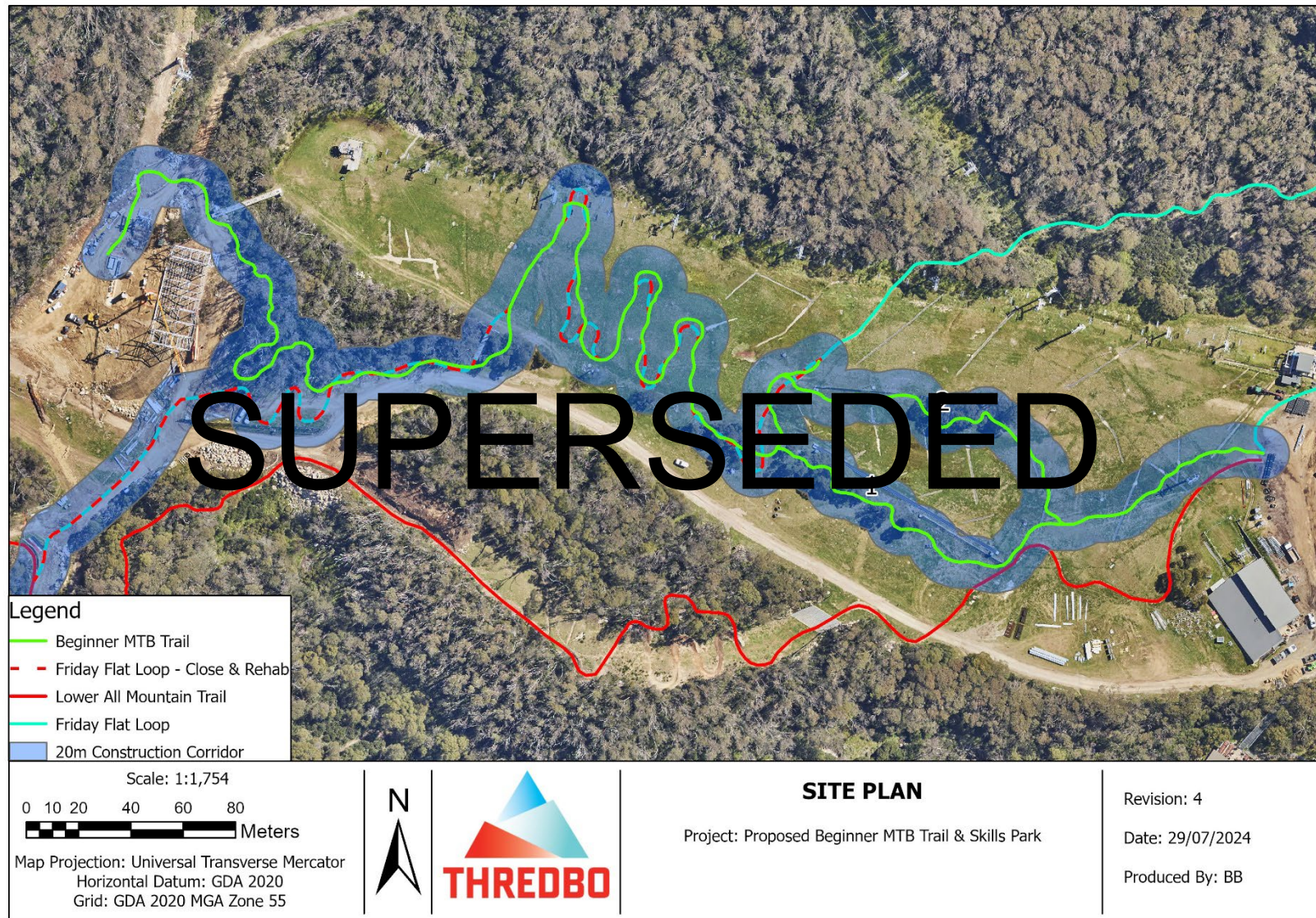
The control of exotic flora is to be undertaken using either spot spraying or hand removal techniques. The spraying activities are to be undertaken using appropriate herbicide for the species being treated and techniques for the conditions on the day. All control activities are to be undertaken prior 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 is an extract from the publication; Rehabilitation Guidelines for the Resort Areas of Kosciuszko National Park (NPWS 2007). The table represents some of the recommended species for revegetation activities within Thredbo at the development site altitude.

Rehabilitation Species List: Thredbo & Bullocks Flat

This appendix provides a list of species known to be successful in rehabilitation, and which would be suited to the Kosciuszko resorts. It does not provide a definitive list of species found in each resort.

Form	Species	Common Name	Community	Propagation and Seed Collection Notes	Direct Seeding
Forbs					
	<i>Craspedia jamesii</i>	James's Billy-button	TAHa, STG	Seed or division	Y
	<i>Craspedia lamicola</i>	Shiny-leaf Billy-button	TAHa, STG	Seed or division	Y
	<i>Craspedia leucantha</i>	Pale Billy-button	SAH, TAHa	Seed or division	Y
	<i>Craspedia maxgrayi</i>	Woolly Billy-button	TAHa, STG	Seed or division	Y
	<i>Helichrysum scorpioides</i>	Button Everlasting	TAHa, W	Seed	Y
	<i>Podolepis robusta</i>	Alpine Podolepis	TAHa, STG	Seed	Y
	<i>Senecio linearifolius</i>	Fireweed Groundsel	SAH, W, SR	Seed	Y
	<i>Stylidium graminifolium</i>	Alpine Trigger-plant	TAHa, STG, H, B, W, SAH, SG	Seed	Y
Grasses, rushes					
	<i>Carex hebes</i>	Dryland Sedge	TAHa, STG	Seed or division	Y
	<i>Poa costiniana</i>	Prickly Snow-grass	STG, F, B, TAHa, H, SAH	Seed or division	Y
	<i>Poa ensiformis</i>	Sword Tussock-grass	W, SAH, SR	Seed or division	Y
	<i>Poa fawcettiae</i>	Smooth-blue Snow-grass	TAHa, STG	Seed or division	Y
	<i>Poa hiemata</i>	Soft Snow-grass	TAHa, SG	Seed or division	Y
Shrubs					
	<i>Acacia obliquinervia</i>	Mountain Hickory Wattle	SAH	Seed (collect in March)	Y
	<i>Cassinia monticola</i>	Cassinia	W, SG		
	<i>Grevillea australis</i>	Royal Grevillea	H, SAH	Tip cutting	
	<i>Hakea microcarpa</i>	Small-fruit Hakea	SAH, W		Y
	<i>Ozothamnus ellipticum</i>	Kerosene Bush	B, H	Soft cutting	
	<i>Ozothamnus secundiflorus</i>	Cascade Everlasting	H, SAH	Soft cutting	
	<i>Podolobium alpestre</i>	Alpine Shaggy-pea	H	Seed (collected in March)	
		<i>Prostanthera cuneata</i>	Alpine Mint-bush	H	Cuttings
Trees					
	<i>Eucalyptus dalrympleana</i>	Mountain Gum	W	Seed	Y
	<i>Eucalyptus delegatensis</i>	Alpine Ash	W	Seed	Y
	<i>Eucalyptus pauciflora</i>	Snow Gum	W	Seed (available all year). 3 weeks cold treatment at 4°C recommended.	Y
	<i>Eucalyptus stellulata</i>	Black Sally	W	Seed (available all year). 3 weeks cold treatment at 4°C recommended.	Y

Key to Communities:

TAHa Tall Alpine Herbfeld *Celmisia* – *Poa* alliance
 TAHb Tall Alpine Herbfeld *Brachyscome* – *Austrodanthonia* alliance
 SAH Short Alpine Herbfeld
 FMa Feldmark *Epacris* – *Chionohebe* alliance
 FMb Feldmark *Coprosma* – *Colobanthus* alliance

H Heath (alpine)
 F Fen
 B Bog
 STG Sod Tussock Grassland
 W Woodland
 SAH Sub-alpine heath
 SR Subalpine Riparian and wet areas
 SG Subalpine Grassland and dry, treeless areas