

# Applicant Information Form 1a Notified or Non-notified Process



Department of  
Conservation  
*Te Papa Atawhai*

New Zealand Government

## Is this the right application form for me?

This **Applicant Information Form 1a** – Notified or Non-notified Process must be completed for **the following longer term applications** (i.e. not one-off applications):

- Grazing
- Land use: Tenanting and/or using existing DOC facility/structure
- Land use: Use of public conservation land for private commercial facility/structure
- Guiding/Tourism/Recreation: Watercraft activities
- Filming
- Sports events
- Marine reserves application form 11a: Structure in a marine reserve

For other activities use the specific activity application forms that combine applicant and activity information or book a pre-application meeting.

## How do I complete this applicant information form?

- Complete all sections of this **applicant information form**.
- In addition, you must complete the **activity application form/s** that you wish to undertake.
- DOC encourages electronic applications (e.g. typed Word document), rather than handwritten applications. Electronic applications are easier to read and less likely to be returned to you for clarification.
- If you need extra space, attach or include extra documents and label them according to the relevant section. Record all attachments in the table at the back of the application information form section **F Attachments**.

## How do I submit my application?

Email the following to [permissions@doc.govt.nz](mailto:permissions@doc.govt.nz):

- **Completed applicant information form 1a**
- **Completed activity application form**
- Any other relevant attachments.

## If I need help, where do I get more information?

- Check the [DOC webpage for the activity you are applying](#)<sup>1</sup> for.

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<sup>1</sup> <https://www.doc.govt.nz/get-involved/apply-for-permits/apply-for-a-permit/>

- Arrange a pre-application meeting (either face to face or over the phone) by contacting the [Department of Conservation Office](#)<sup>2</sup> closest to where the activity is proposed. You can use [DOC maps](#)<sup>3</sup> to identify which District Office you should contact. Or arrange a meeting with any of our [four offices that process concessions](#)<sup>4</sup> – choose the one closest to where the activity is proposed.
- If your application covers multiple districts, contact the office nearest most of the locations you are applying for, or nearest to locations you have a specific question about.

### What happens next?

Once your application forms are received, your application will be assessed by DOC. If your application is complete, DOC will begin processing.

If your application is incomplete it will be returned to you for more information.

### Why does DOC ask for this information?

The questions in this application information form and the activity application form/s are designed to cover the requirements set out in conservation legislation. Your answers allow us to assess:

- Your most up-to-date details so that DOC can contact you about your application.
- Your qualifications, resources, skills and experience to adequately conduct the activity on public conservation land.
- Your creditworthiness will help determine whether DOC should extend credit to you and set up a DOC customer accounts receivable credit account for cost recovery. To make this assessment DOC will supply your information to a credit checking agency.

### Note:

- Personal information will be managed by DOC confidentially. For further information check [DOC's privacy and security statements](#)<sup>5</sup>.
- Information collected by DOC will be supplied to a debt collection agency in the event of non-payment of payable fees.

### What fees will I pay?

You may be required to pay a **processing fee** for this application regardless of whether your application is granted or not. You may request an estimate of the processing fees for your application. If you request an estimate, DOC may require you to pay the reasonable costs of the estimate prior to it being prepared. DOC will not process your application until the estimate has been provided to you. In addition, if you are granted a guiding concession on public conservation land you may be required to pay annual **activity and management fees**. These fees are listed on the [DOC webpage for the activity you are applying](#)<sup>6</sup> for.

DOC will invoice your processing fees after your application has been considered. If your application is large or complex, DOC may undertake billing at intervals periodically during processing until a decision is made. If you withdraw your application DOC will invoice you for the costs incurred up to the point of your withdrawal.

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<sup>2</sup> [www.doc.govt.nz/footer-links/contact-us/office-by-name/](http://www.doc.govt.nz/footer-links/contact-us/office-by-name/)

<sup>3</sup> <http://maps.doc.govt.nz/mapviewer/index.html?viewer=docmaps>

<sup>4</sup> <https://www.doc.govt.nz/get-involved/apply-for-permits/contacts>

<sup>5</sup> <https://www.doc.govt.nz/footer-links/privacy-and-security/>

<sup>6</sup> <https://www.doc.govt.nz/get-involved/apply-for-permits/apply-for-a-permit/>

**Your application will set up a credit account with DOC.** See the checklist at the end of the form for the terms and conditions you need to accept for a DOC credit account.

### **Will my application be publicly notified?**

Your application will be publicly notified if:

- It is a license with a term of more than 10 years.
- It is a lease.
- After having regard to the effects of the activity, DOC considers it appropriate to do so.

Public notification will increase the time and cost of processing of your application.

### **What does DOC require if my application is approved?**

If your application is approved DOC requires:

- **Insurance** to indemnify the Minister of Conservation against any claims or liabilities arising from your actions. The level of insurance cover will depend on the activity.
- A copy of your **safety plan** audited by an external expert (e.g. Health and Safety in Employment (Adventure Activity) Regulations 2011 audit or a DOC listed organisation). See the [Safety Plan](#)<sup>7</sup> information on the DOC website for further information.

**Note:** DOC/Minister can vary the concession if the information on which the concession was granted contained material inaccuracies. DOC may also recover any costs incurred.

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<sup>7</sup> <https://www.doc.govt.nz/get-involved/apply-for-permits/managing-your-concession/safety-plans/>

## A. Applicant details

Legal status of applicant (tick)	<input type="checkbox"/> Individual (Go to ①)	
	<input checked="" type="checkbox"/> Registered company (Go to ②)	<input type="checkbox"/> Trust (Go to ②)
	<input type="checkbox"/> Incorporated society (Go to ②)	<input type="checkbox"/> Other e.g. Educational institutes (Go to ②)

①	Applicant name (individual)			
	Phone		Mobile phone	
	Email			
	Physical address		Postcode	
	Postal address (if different from above)		Postcode	

②	Applicant name (full name of registered company, trust, incorporated society or other)			NZSki Limited
	Trading name (if different from applicant name)			
	NZBN if applicable (to apply go to: <a href="https://www.nzbn.govt.nz">https://www.nzbn.govt.nz</a> )	9429036516582	Company, trust or incorporated society registration number	
	Registered office of company or incorporated society (if applicable)			
	Company phone		Company website	<a href="http://www.nzski.com">www.nzski.com</a> or <a href="http://www.coronetpeak.co.nz">www.coronetpeak.co.nz</a>
	Contact person and role			Nigel Kerr
	Phone		Mobile phone	
	Email			
	Postal address	POBox 359, Queenstown 9348	Postcode	

Street address (if different from postal address)

L2, The Station Bldg, Corner  
Camp & Shotovers Sts,  
Queenstown

Postcode

9300

## B. Pre-application meeting

Have you had a pre-application meeting or spoken to someone in DOC?

No

Yes

- If yes record the:

Date of DOC pre-application meeting

13<sup>th</sup> May 2022

Name of DOC staff member

David Butt

Name of person who had the pre-application meeting with DOC

Nigel Kerr

## C. Activity applied for

Tick the **activity application form** applicable to the activity you wish to undertake on public conservation land. Complete the applicant information form and the activity application form and email them with any attachments to [permissions@doc.govt.nz](mailto:permissions@doc.govt.nz)

ACTIVITY APPLICATION FORM*	FORM NO.	TICK
Grazing	2a	<input type="checkbox"/>
Land use: Tenanting and/or using existing DOC facility/structure	3a	<input type="checkbox"/>
Land use: Use of public conservation land for private/commercial facility/structure	3b	<input type="checkbox"/>
Guiding/Tourism/Recreation: Watercraft activities	4b	<input type="checkbox"/>
Filming	5a	<input type="checkbox"/>
Sporting Events	6a	<input type="checkbox"/>
Marine reserves application form: Structure in a marine reserve	11a	<input type="checkbox"/>
Other activities (not covered in the above forms or in the new activity application forms that combine applicant and activity information)	7a	<input checked="" type="checkbox"/>

**Note:** If the activity is not in this list check the activity on the DOC website to find the correct application form or book a pre-application meeting. Application forms that combine applicant and activity information on the DOC website include:

- [Aircraft activities](#)<sup>8</sup>
- [Easements](#)<sup>9</sup>

<sup>8</sup> <https://www.doc.govt.nz/get-involved/apply-for-permits/business-or-activity/aircraft-activities/>

<sup>9</sup> <https://www.doc.govt.nz/get-involved/apply-for-permits/business-or-activity/access-easements/>

- [Land based guiding](#)<sup>10</sup>

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<sup>10</sup> <https://www.doc.govt.nz/get-involved/apply-for-permits/business-or-activity/land-based-guided-activities/>

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## D. Are you applying for anything else?

Are you submitting any other application forms in relation to this application?

No

Yes

- If yes, state which application forms:

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## E. Background experience of applicant

Provide relevant information relating to your ability to carry out the proposed activity (e.g. details of previous concessions, membership of professional organisations, and relevant qualifications).

NZSki Limited the applicant has been operating and managing Coronet Peak Ski Area within the Coronet Peak Recreation Reserve for many years under the term of a lease and supporting authorisations from the Dept of Conservation.

Over the last 15 years Coronet Peak has developed three Mountain Bike trails in the reserve following DOC guidelines. The partial CMS review has also been publicly notified recently and from that process MTB development in the Coronet Peak Rec reserve approved.

## F. Attachments

Attachments should *only* be used if there is:

- Not enough space on the form to finish your answer
- You have additional information that supports your answer
- You wish to make an additional request of DOC regarding the application.

Label each document clearly and complete the table below.

Section of the application form the attachment relates to	Document title	Document format (e.g. Word, PDF, Excel, jpg etc.)	Description of attachment
A	CP trail Locations	PDF	Map of existing and proposed trails and grading
B	NZMTB Trail grading	PDF	Trail grading and building guidance
C	DOC 6789733	PDF	Earlier DOC trail building conditions.
D	CP Masterplan	PDF	Proposed conditions for trail building at CP
E	MTB Flyover	PDF	Trail crossing
F	MTB Bridge	PDF	Water crossing
G	E3 scientific report	PDF	Environmental consultants report
H	CP application 7a	PDF	DOC official application form

## G. Checklist

Application checklist	Tick
I have completed all sections of this applicant information form relevant to my application and understand that the form will be returned to me if it is incomplete.	<input checked="" type="checkbox"/>
I certify that the information provided in this applicant information form, and any attached additional forms is, to the best of my knowledge, true and correct.	<input checked="" type="checkbox"/>
I have completed the <b>activity application form</b> .	<input checked="" type="checkbox"/>
I have appropriately labelled all attachments and completed section <b>F Attachments</b> .	<input checked="" type="checkbox"/>
I will email <a href="mailto:permissions@doc.govt.nz">permissions@doc.govt.nz</a> my: <ul style="list-style-type: none"> <li>• Completed applicant information form</li> <li>• Completed activity application form/s</li> </ul>	<input checked="" type="checkbox"/>



- Any other attachments.

## H. Terms and conditions for a credit account with the Department of Conservation

Have you held an account with the Department of Conservation before?	Tick
No	<input type="checkbox"/>
Yes	<input checked="" type="checkbox"/>
If 'yes' under what name	NZSki

In ticking this checklist and placing your name below you are acknowledging that you have read and agreed to the terms and conditions for an account with the Department of Conservation

Terms and conditions	Tick
I/We agree that the Department of Conservation can provide my/our details to the Department's Credit Checking Agency to enable it to conduct a full credit check.	<input checked="" type="checkbox"/>
I/We agree that any change which affects the trading address, legal entity, structure of management or control of the applicant's company (as detailed in this application) will be notified in writing to the Department of Conservation within 7 days of that change becoming effective.	<input checked="" type="checkbox"/>
I/We agree to notify the Department of Conservation of any disputed charges within 14 days of the date of the invoice.	<input checked="" type="checkbox"/>
I/We agree to fully pay the Department of Conservation for any invoice received on or before the due date.	<input checked="" type="checkbox"/>
I/We agree to pay all costs incurred (including interest, legal costs and debt recovery fees) to recover any money owing on this account.	<input checked="" type="checkbox"/>
I/We agree that the credit account provided by the Department of Conservation may be withdrawn by the Department of Conservation, if any terms and conditions (as above) of the credit account are not met.	<input checked="" type="checkbox"/>
I/We agree that the Department of Conservation can provide my details to the Department's Debt Collection Agency in the event of non-payment of payable fees.	<input checked="" type="checkbox"/>

Typed applicant name/s	Nigel Kerr	Date	24/05/22
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For Departmental use	
Credit check completed	
Comments:	
Signed	Name

Approved (Tier 4 manager  
or above)

Name



The Department recommends that you contact the Department of Conservation Office closest to where the activity is proposed to discuss the application prior to completing the application forms. Please provide all information requested in as much detail as possible. Applicants will be advised if further information is required before this application can be processed by the Department.

This form is to be used when your activity does not fall into any of the other categories. It is to be completed in conjunction with either Applicant Information Form 1a (longer term concession) or Applicant Information Form 1b (one-off concession) as appropriate.

- If your application involves guiding clients on public conservation land eg walking, kayaking, 4WD, hunting, aircraft landings, please fill in Forms 4a, 4b and/or Form 4c as applicable.
- If your application includes building, extending or adding to any permanent or temporary structures or facilities on public conservation land, please also fill in Form 3b,
- If your application includes tenancy of any DOC managed buildings (other than overnight usage of huts) please also fill in Form 3a.
- If your application is for access across public conservation land please fill in Form 3c.

Please complete this application form, attach Form 1a or Form 1b, and any other applicable forms and information and send to [permissions@doc.govt.nz](mailto:permissions@doc.govt.nz). The Department will process the application and issue a concession if it is satisfied that the application meets all the requirements for granting a concession under the Conservation Act 1987.

If you require extra space for answering please attach and label according to the relevant section.

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## A. Description of Activity

Please describe the proposed activity(s) in detail.

Please include the name and status of the public conservation land, the size of the area you are applying for and why this area has been chosen.

Please attach maps of the location and any detailed site plan, any drawings of proposal and label Attachment 7a:A.

To build a range of MTB trails in the Coronet Peak Recreational Reserve.. The trails are in the main bounded by the area currently used for skiing. The exception is two trails that descend down the Coronet face on into the LINZ land below the Coronet Peak reserve.

The trails length, development pathway and proposed grading are all in attachment A. Summary is below.

Name	Grade	Status	Length (m)
Coronet DH	Grade 5: Expert	Existing	1859
Coronet XC	Grade 3: Intermediate	Existing	2799
Rude Rock Link	Grade 4: Advanced	Existing	397
Upper Rude Rock	Grade 4: Advanced	Existing	3293
Cold Play	Grade 6: Extreme	Proposed	330
Freewheeler	Grade 5: Expert	Proposed	538
Ka Kite Ano	Grade 3: Intermediate	Proposed	3508
Kids Loop	Grade 3: Intermediate	Proposed	222
No THYME	Grade 6: Extreme	Proposed	783
Oblivion	Grade 4: Advanced	Proposed	833
Tally Ho	Grade 4: Advanced	Proposed	551
Velvet Rolls	Grade 3: Intermediate	Proposed	596
Way Wide	Grade 3: Intermediate	Proposed	869
Whakatipu View	Grade 2: Easy	Proposed	3232
Whee	Grade 2: Easy	Proposed	229
World Cup	Grade 6: Extreme	Proposed	1847

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## B. Term

Please detail the length of the term sought (i.e. number of years or months) and why. If you are applying for a one-off permit please state the specific dates and/or times sought.

*Note: An application for a concession for a period over 10 years must be publicly notified, an application for a concession up to 10 years will not be publicly notified unless the adverse effects of the activity are such that it is required, or if an exclusive interest in the land is required.*

The goal in this application is for DOC to assess the cumulative effect of proposed trail building in the Coronet Peak recreational reserve. The plan has taken feedback on from the QMTBC, local riders and the Queenstown Trails Trust. It is believed that this is a far better approach than dealing with piecemeal applications.

Because of this any permit to build these trails needs to be valid for a realistic time span, say seven years initially. This will not come to fruition over night.

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## C. Bulk fuel storage

Under the Hazardous Substances and New Organisms Act 1996 (HSNO Act) 'Bulk fuel storage' is considered to be any single container, stationary or mobile, used or unused, that has a capacity in excess of 250 litres of Class 3 fuel types. This includes petrol, diesel, aviation gasoline, kerosene and Jet A1. For more information on Hazardous Substances, go to:

<http://www.business.govt.nz/worksafe/information-guidance/legal-framework/hsno-act-1996>

Do you intend to store fuel in bulk on the land as part of the activity?

**YES / NO**

If you have answered yes, then please provide full details of how and where you intend to store the fuel, and label any attachments including plans, maps and/or photographs as Attachment 7a:C. If your concession application is approved you will be required to provide a copy of your HSNO compliance certification to the Department before you begin the activity.

## D. Environmental Impact Assessment

This section is one of the most important factors that will determine the Department's decision on the application. Please answer in detail.

I have deleted Column 1 as the location is singular, being Coronet Peak Recreation Reserve.

Refer to Steps 1 and 2 in your Guide to Environmental Impact Assessment to help you fill in this section.

Special feature or value	Potential effects of your activity on the feature or value (positive or adverse)	Methods to remedy, mitigate or avoid any adverse effects identified
<p><b>Recreation Value -</b></p> <p>Proximity of reserve from Queenstown;</p> <p>Already known for MTB riding.</p>	<ul style="list-style-type: none"> <li>Conflict between different use of the land and visitors to the reserve. (-ve)</li> <li>Increased recreation opportunity ( +ve)</li> <li>Providing a wider range of facilities, Trails graded from level 2 – 6 to enable a larger range of people to enjoy (+ve)</li> </ul>	<ul style="list-style-type: none"> <li>Ensure the public understand and have knowledge that the use of the trails is the designated place for MTB and avoid conflicts between different users.</li> <li>The new MTB trails have been located so they will not impinge on other users' access nor enjoyment of the Coronet Peak reserve.</li> <li>The improved range of trails will attract more users to the Coronet Peak reserve.</li> <li>The trails will be built to current trail building standards. This will improve safety and enjoyment on the trails.</li> <li>The new trails will be maintained actively and improve the enjoyment of this public conservation area.</li> </ul>
<p><b>Terrestrial Value –</b></p> <p>Reserve altitudinal range is from Approx. 1000m to 1651m ASL. The trails run from 1600-1160m so effectively through the full altitudinal range. Two even run to the LINZ boundary below the reserve, as low as</p>	<ul style="list-style-type: none"> <li>Disturbance and modification to the reserve land.</li> <li>Reduction of native vegetation and habitats.</li> <li>Introduction of new or existing</li> </ul>	<ul style="list-style-type: none"> <li>The Coronet Peak Recreation Reserve is an already modified reserve in part. The proposed trails in this application are situated within the modified terrain, that has existing tracks/trails for mountain biking and the ski area. All efforts will be used to ensure the construction disturbance is limited to the trails and the</li> </ul>

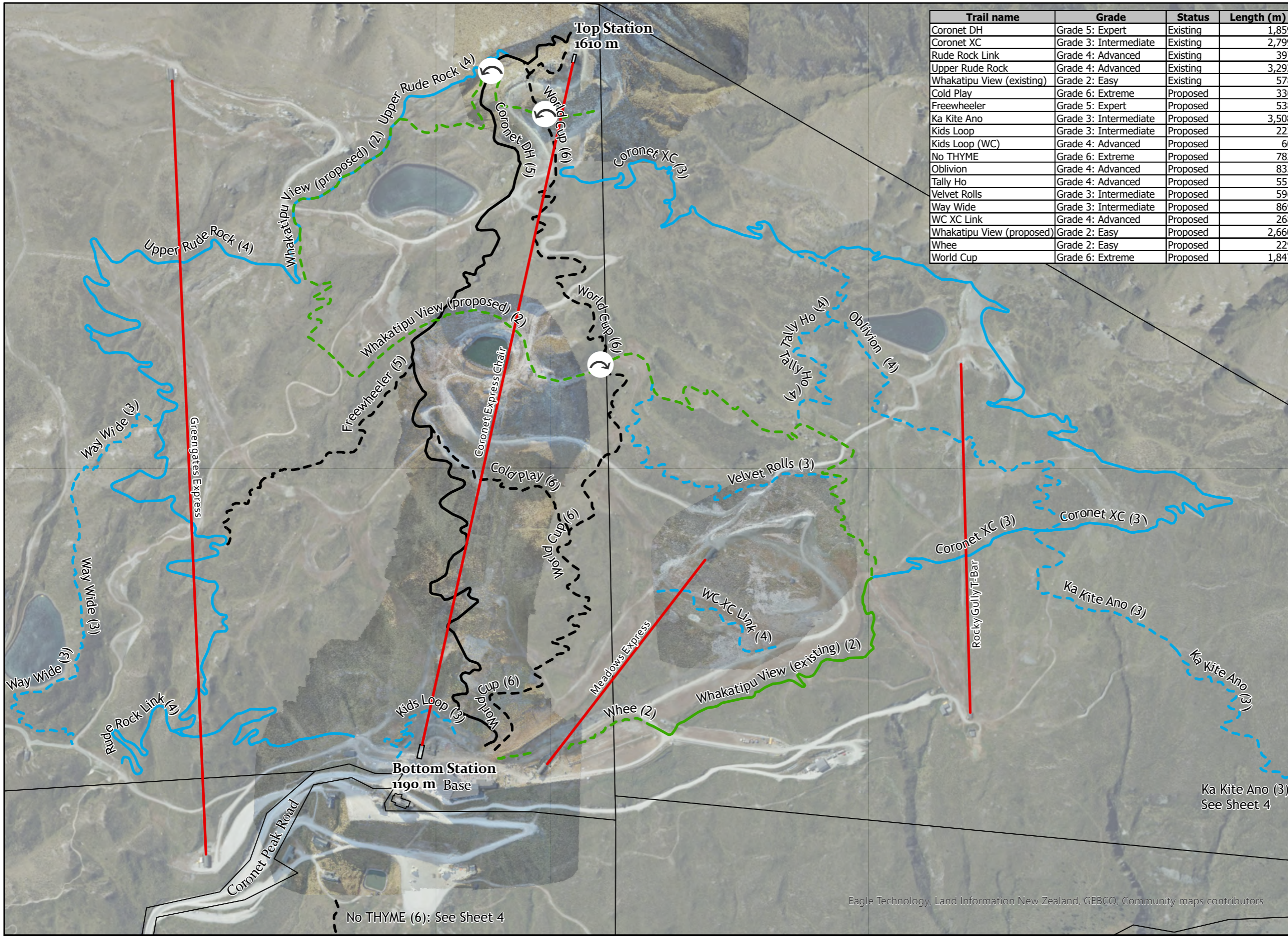
<p>960m.</p> <p>Flora: native shrubland mixed with tall tussock, and cushion fields, rocky outcrops, wetlands, tarns and exotic grasslands.</p> <p>Fauna: the following birds are known to be found and use the alpine natural habitats; Kārearea/New Zealand Falcon, Kea, Pihoihoi/New Zealand Pipit; and the Pūtangitangi/Paradise Shelduck, and present are small introduced passerine.</p> <p>Lizards: recorded within the reserve were the McCann's and the Southern Grass skinks.</p> <p>Many invertebrate species have been recorded in the recreation reserve, including many moth's species.</p> <p>Alpine Tarns are found within the reserve.</p>	<p>threats (weeds) to natural environments and ecosystems.</p> <ul style="list-style-type: none"> <li>Continued pest and weed control programmes (positive).</li> </ul>	<p>land directly surrounding the earthworks.</p> <ul style="list-style-type: none"> <li>The trails have been designed to purposely avoid all wetlands and tarns. It has also been aligned to minimise interactions across cushion fields.</li> <li>A methodology for minimising and replanting the disturbed vegetation will be followed through both trails' construction.</li> <li>The trails contain the areas in which MTB will be able to ride. Minimising 'wilding' riding across the wider reserve. Potentially reducing adverse impacts on the flora and fauna of the reserve i.e. accidental trampling of cushion fields, invertebrates, or disturbance to lizards or birds.</li> <li>NZSki will continue with trapping programmes and woody weed removal to reduce animal pest and weed spread.</li> <li>Any equipment brought onto the reserve is checked and will be weed and pest free.</li> <li>The only materials brought on for this shall be culverts and bridging. None of these will contain seeds.</li> <li>The building of the trails will be monitored regularly by DOCs appointed advisor or DOC themselves.</li> </ul>
<p><b>Landscape and Scenic Value-</b></p> <p>Coronet Peak massif, the northern frame of the Wakatipu Basin, is a series of summits, ridges and valleys, punctuated by rocky outcrops, scrub and tussock clad slopes.</p> <p>The area of land under application is within a modified alpine, ski area landscape.</p>	<p>Modification of the natural environment</p>	<ul style="list-style-type: none"> <li>The best way to understand what the trails will look like as they grow in is to review the existing mountain trails constructed in 2005 and the new Upper Rude Rock built in the last six months.</li> <li>The visibility of the trails will be mitigated by the fact that they are shallow and narrow. Built mainly into tussock/Dracophylum shrubland which grows up and obscures the trail rapidly.</li> <li>With all berms replanted the riding surface is soon obscured. All corners will be in 'off piste' areas of the ski area.</li> </ul>

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## **E. Other**

Is there any further information you wish to supply in support of your application?

- A. Coronet Peak MTB Network map
- B. Mountain Bike Trail guidelines
- C. CP Conditions for Trails 6789733
- D. CP Masterplan MTB 25.05.22
- E. Coronet Peak MTB Flyover bridge
- F. Coronet Peak MTB stream crossing bridge
- G. E3 scientific ecological report



Trail name	Grade	Status	Length (m)
Coronet DH	Grade 5: Expert	Existing	1,859
Coronet XC	Grade 3: Intermediate	Existing	2,799
Rude Rock Link	Grade 4: Advanced	Existing	397
Upper Rude Rock	Grade 4: Advanced	Existing	3,293
Whakatipu View (existing)	Grade 2: Easy	Existing	578
Cold Play	Grade 6: Extreme	Proposed	330
Freewheeler	Grade 5: Expert	Proposed	538
Ka Kite Ano	Grade 3: Intermediate	Proposed	3,508
Kids Loop	Grade 3: Intermediate	Proposed	222
Kids Loop (WC)	Grade 4: Advanced	Proposed	60
No THYME	Grade 6: Extreme	Proposed	783
Oblivion	Grade 4: Advanced	Proposed	833
Tally Ho	Grade 4: Advanced	Proposed	551
Velvet Rolls	Grade 3: Intermediate	Proposed	596
Way Wide	Grade 3: Intermediate	Proposed	869
WC XC Link	Grade 4: Advanced	Proposed	268
Whakatipu View (proposed)	Grade 2: Easy	Proposed	2,660
Whee	Grade 2: Easy	Proposed	229
World Cup	Grade 6: Extreme	Proposed	1,847

**Mountain Bike Trail Grades**

**Existing**

- Grade 2: Easy
- Grade 3: Intermediate & 4: Advanced
- Grade 5: Expert & 6: Extreme

**Proposed**

- Grade 2: Easy
- Grade 3: Intermediate & 4: Advanced
- Grade 5: Expert & 6: Extreme

Bridge  
 Lift Line  
 Property Boundary

**Disclaimer:**

Any person using Southern Land drawings and other data accepts the risk of: using the drawings and other data in electronic form without requesting and checking them for accuracy against the original hard copy versions or with Southern Land directly and ensuring the information is the most recent issue. If this plan is being used for resource consent purposes then areas and dimensions should be considered indicative and subject to final Land Transfer Survey. As areas and dimensions may vary upon survey it should not be attached to sale & purchase agreements without an appropriate condition to cover such variations.

**SOUTHERN LAND**  
DEVELOPMENT CONSULTANTS

Rev.	Date	Details	By
A	27/04/22	Original Issue	CS
B	10/05/22	Track edits & grading	CS
C	17/05/22	Track edits	CS
D	25/05/22	Track edits	CS
E	28/06/22	Track edits	CS

**Coronet Peak Mountain Bike Trails Existing & Proposed - Masterplan**

Client **nzski**

Drawing Reference: W3100\_M7 | Sheet: 1 of 5

Scale: 1:6,000

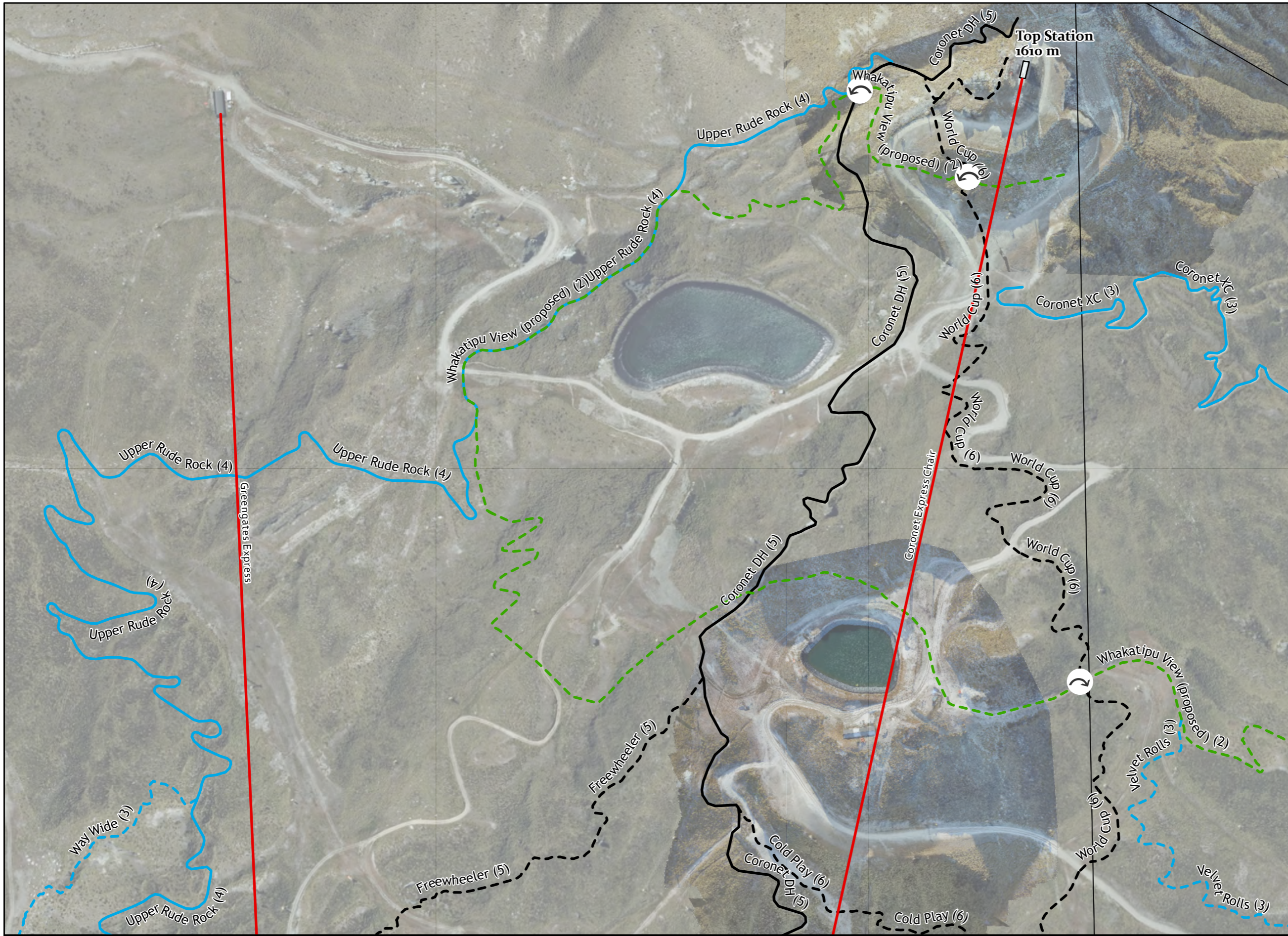
Surveyed: - | Checked: - | Date: -

Drawn: CS | Approved: AJHB | Date: 25/05/22 | Datum & Level: NZTM & DVD1958 (MSL) | Rev: E

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Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributors





**Mountain Bike Trail Grades**

**Existing**

- Grade 2: Easy (Solid Green line)
- Grade 3: Intermediate & 4: Advanced (Solid Blue line)
- Grade 5: Expert & 6: Extreme (Solid Black line)

**Proposed**

- Grade 2: Easy (Dashed Green line)
- Grade 3: Intermediate & 4: Advanced (Dashed Blue line)
- Grade 5: Expert & 6: Extreme (Dashed Black line)

- Bridge (White arrow symbol)
- Lift Line (Red line)
- Property Boundary (White outline)

**Disclaimer:**

Any person using Southern Land drawings and other data accepts the risk of: using the drawings and other data in electronic form without requesting and checking them for accuracy against the original hard copy versions or with Southern Land directly and ensuring the information is the most recent issue. If this plan is being used for resource consent purposes then areas and dimensions should be considered indicative and subject to final Land Transfer Survey. As areas and dimensions may vary upon survey it should not be attached to sale & purchase agreements without an appropriate condition to cover such variations.

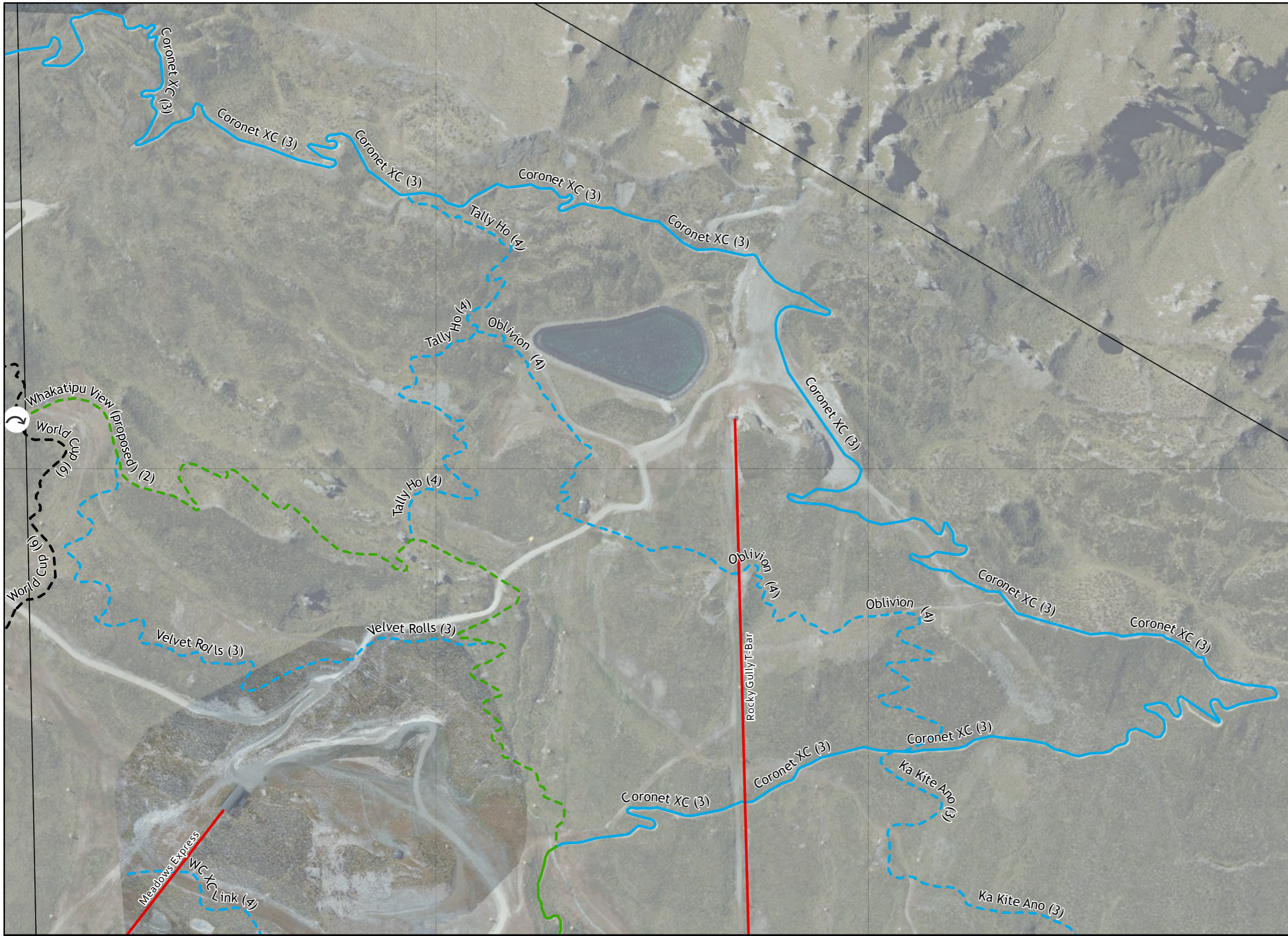
N

**SOUTHERN LAND**  
DEVELOPMENT CONSULTANTS

Rev.	Date	Details	By
A	27/04/22	Original Issue	CS
B	10/05/22	Track edits & grading	CS
C	17/05/22	Track edits	CS
D	25/05/22	Track edits	CS
E	28/06/22	Track edits	CS

**Coronet Peak  
Mountain Bike Trails  
Existing & Proposed - Masterplan**

Client				Drawing Reference	Sheet
				W3100_M7	2 of 5
Surveyed	Checked	Date	Scale		
-	-	-	1:3,000		
Drawn	Approved	Date	Datum & Level	Rev.	
CS	AJHB	25/05/22	NZTM & DVD1958 (MSL)	E	



**Mountain Bike Trail Grades**

**Existing**

- Grade 2: Easy (Green solid line)
- Grade 3: Intermediate & 4: Advanced (Blue solid line)
- Grade 5: Expert & 6: Extreme (Black solid line)

**Proposed**

- Grade 2: Easy (Green dashed line)
- Grade 3: Intermediate & 4: Advanced (Blue dashed line)
- Grade 5: Expert & 6: Extreme (Black dashed line)

- Bridge (Black curved arrow)
- Lift Line (Red solid line)
- Property Boundary (Black outline)

**Disclaimer:**

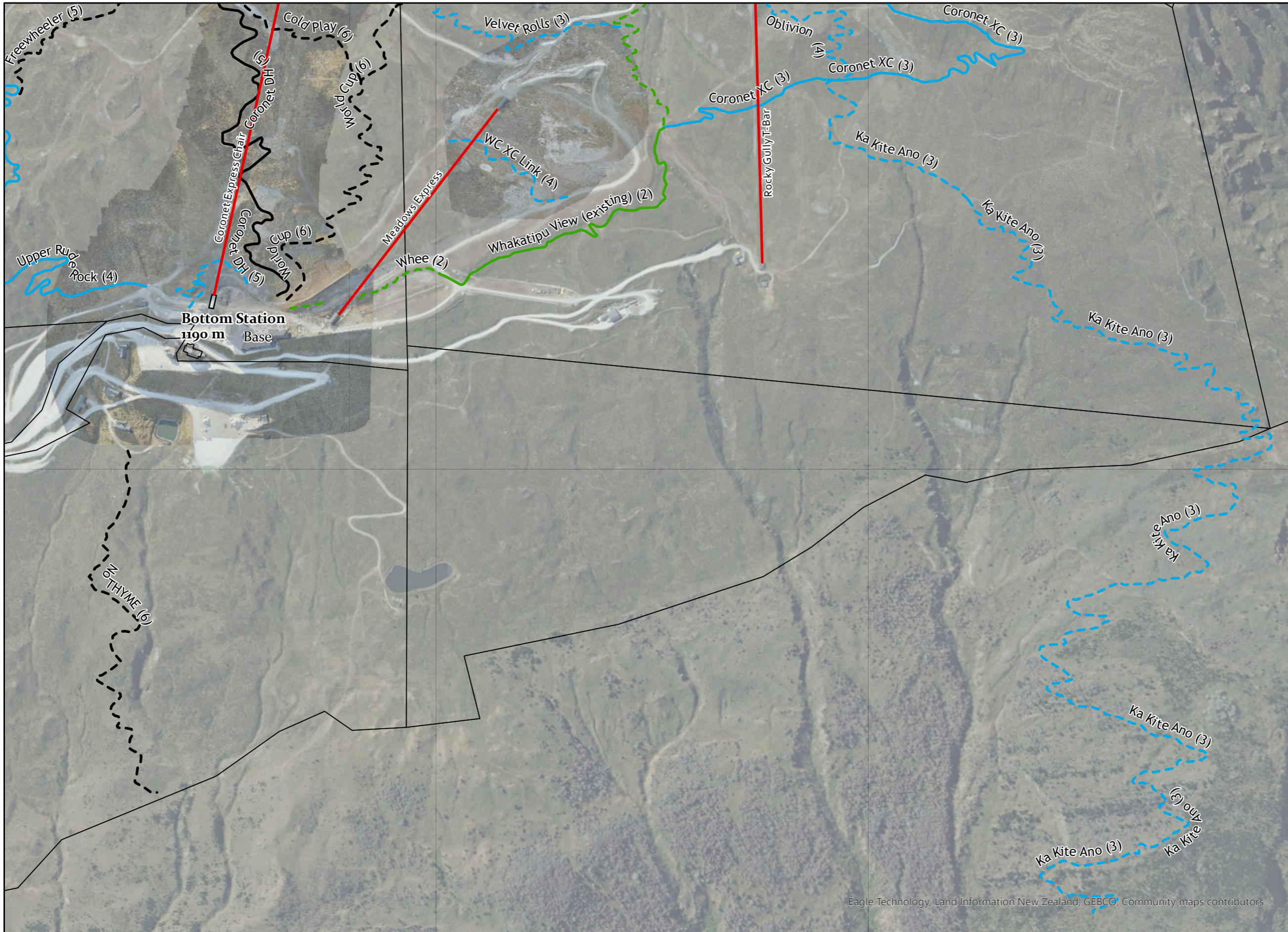
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**SOUTHERN LAND**  
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Rev.	Date	Details	By
A	27/04/22	Original Issue	CS
B	10/05/22	Track edits & grading	CS
C	17/05/22	Track edits	CS
D	25/05/22	Track edits	CS
E	28/06/22	Track edits	CS

**Coronet Peak  
Mountain Bike Trails  
Existing & Proposed - Masterplan**

Client		Drawing Reference	Sheet
		W3100_M7	3 of 5
Surveyed	Checked	Date	Scale
-	-	-	1:3,000
Drawn	Approved	Date	Datum & Level
CS	AJHB	25/05/22	NZTM & DVD1958 (MSL)
			Rev.
			E



**Mountain Bike Trail Grades**

**Existing**

- Grade 2: Easy
- Grade 3: Intermediate & 4: Advanced
- Grade 5: Expert & 6: Extreme

**Proposed**

- Grade 2: Easy
- Grade 3: Intermediate & 4: Advanced
- Grade 5: Expert & 6: Extreme

- Bridge
- Lift Line
- Property Boundary

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**Coronet Peak  
Mountain Bike Trails  
Existing & Proposed - Masterplan**

Client

Drawing Reference: W3100\_M7      Sheet: 4 of 5

Surveyed	Checked	Date	Scale	
-	-	-	1:6,000	
Drawn	Approved	Date	Datum & Level	Rev.
CS	AJHB	28/06/22	NZTM & DVD1958 (MSL)	E

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**Mountain Bike Trail Grades**

**Existing**

- Grade 2: Easy
- Grade 3: Intermediate & 4: Advanced
- Grade 5: Expert & 6: Extreme

**Proposed**

- Grade 2: Easy
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- Grade 5: Expert & 6: Extreme

- Bridge
- Lift Line
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**Coronet Peak  
Mountain Bike Trails  
Existing & Proposed - Masterplan**

Client

Drawing Reference: W3100\_M7 | Sheet: 5 of 5

Scale: 1:3,000

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			Rev.
			E

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# New Zealand Mountain Bike Trail Design & Construction Guidelines



# New Zealand Mountain Bike Trail Design & Construction Guidelines

Mountain Biking has quickly become a mainstream sport, with a broad range of bike trails being developed all around New Zealand.

Projects are now being driven by land managers such as DOC, Iwi, local and regional councils and also private land owners, adding a more structured and professional approach to complement the well established volunteer based, club driven structure.

Often the project manager or engineer managing the project has no background in the sport, and the volunteer driver may be light on the steps needed to produce a fit for purpose product.

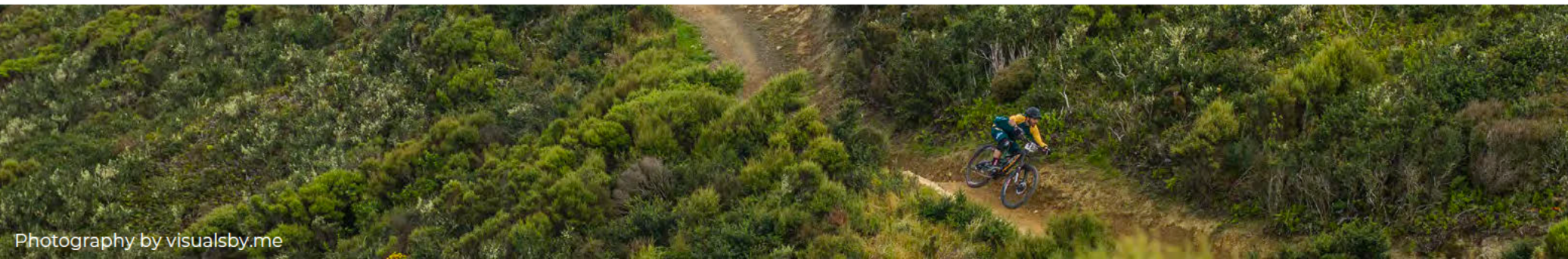
This new guideline is intended to help all parties develop and clarify their understanding of the creative elements that go into delivering a fun trail experience at each of the six different grades of difficulty.

This guideline gives a detailed and defined specification for new trails at each grade, and also provides a template for the maintenance and auditing of existing trails. Any organisation involved with developing, building, maintaining or auditing a trail is encouraged to use these guidelines - with the over riding goal for NZ being a level of consistency and continuity around trail grading to ensure a fantastic user experience



## Trail Specifications

Specification	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 Expert	Grade 6 Extreme
Target Audience	Suitable for all ages and most fitness levels. The trail feels safe to ride and is ideal as a first ride for non-cyclists, and those wanting an easy gradient or experience. They shall be well formed, flat, wide and smooth. The trail allows for cyclists to ride two abreast most of the time, and provides a social component to the ride. Cyclists will be able to ride the total distance of the trail without dismounting for obstacles.	Riders develop balance and gear choice skills. Trail shall be well formed, smooth and with some gentle climbs, is predictable with no surprises and is suitable for beginner riders. Trail has a social aspect with riders being able to ride side by side at times but the majority of the trail provides for a single rider. Suitable for most ages and fitness levels	Riders develop controlled braking skills, and gain riding experience. These trails can be narrow with some hills to climb. There may also be some exposure to drop-offs. Rider needs the skills to ride narrower tracks and maintain balance on a narrower surface, steer to avoid or ride over obstacles up to 100mm high or deep	Riders develop accurate line choice, controlling braking on the edge of traction, and gain further riding experience. Obstacles increase in size and frequency, track width varies. Some backcountry trails may also be 2- way at this grade.	Riders develop skills to control a bike in sections of trail where there is poor or no traction. Grade 5 trails are technically challenging with big hills, often lots of rocks and some walking likely. Grade 5 trails may traverse a wide range of terrain and cater for riders with generally high levels of skills and experience. Easier "B" Lines should be provided around un-rollable obstacles. Trails at this grade should be 1-way.	Riders develop supreme bike and tyre placement accuracy. Trail may not be passable in wet weather conditions. These trails include those purposely built downhill / free ride trails for technically advanced and highly experienced riders. Grade 6 trails may traverse a wide range of terrain with large jumps and obstacles catering for extreme riders, without easier "B" lines. Trails at this grade should be 1-way.
Sideslope <5°	Minimum Trail Tread Width 1-way or 2-way 1.5m	Minimum Trail Tread Width 1-way: 900mm, 2-way: 1.2m	Minimum Trail Tread Width 1-way: 600mm, 2-way: 1.2m	Minimum Trail Tread Width 300mm	Minimum Trail Tread Width 250mm	Minimum Trail Tread Width 100mm
Sideslope 5-15°	1-way or 2-way 1.5m	1-way: 900mm, 2-way: 1.2m	1-way: 800mm, 2-way: 1.2m	300mm	250mm	100mm
Sideslope 15-30°	1-way or 2-way 1.8m	1-way or 2-way 1.2m	1-way: 900mm, 2-way: 1.2m	400mm	250mm	100mm
Sideslope 30-45°	1-way or 2-way 2m	1-way or 2-way 1.2m	1-way or 2-way 1.2m	500mm	250mm	100mm
Sideslopes over 45°	1-way or 2-way 2.5m	1-way or 2-way 1.5m	1-way or 2-way 1.2m	600mm	250mm	100mm
2-way Width	Regular passing bays, and/or wider sections of trail should be incorporated to assist 2-way trail flow				1-way trails only	
Guidance	<ul style="list-style-type: none"> <li>As sideslope on the downhill side of the track increases, the consequence of fall increases, therefore the skill level required to ride the track safely increases. Allow extra width where side slopes are steepest.</li> <li>Grade reversals are recommended at intervals relative to the gradient and soil type of the trail; spacing between reversals should decrease as gradient increases (see table 1). A grade reversal should occur at every unbridged water crossing point.</li> <li>Tread outslope of 3-5° should be utilised where ever possible (except for insloped corners and where insloped water table drains are needed for boggy ground)</li> </ul>					



## Uphill Trails

Specification	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 Expert	Grade 6 Extreme
<b>UPHILL TRAILS</b>						
Target Average Gradient	2° (1 in 28.6) for no less than 98% of the trail.	3.5° ± 1° (1 in 16.3) for no less than 95% of the trail.	5° ± 1° (1 in 11.4) for no less than 90% of the trail.	6° ± 1° (1 in 10.5) for 90% of the trail.	10° (1 in 5.7) for 90% of the trail.	15° (1 in 3.7) for 90% of the trail.
(A) Steeper uphill gradients may occur up to 200m long.	Maximum of 3° (1 in 19.1)	Maximum of 5° (1 in 11.4)	Maximum of 7° (1 in 8.2)	Maximum of 9° (1 in 6.3)	Maximum of 13° (1 in 4.3)	Maximum of 16° (1 in 3.1)
(B) for slopes up to 10-20m long.	Maximum of 4° (1 in 14.3) for up to 10m	Maximum of 6° (1 in 10.5) for up to 10m	Maximum of 10° (1 in 6.3) for up to 10m	Maximum of 12° (1 in 5.1) for up to 15m	Maximum of 15° (1 in 3.7) for up to 15m	Maximum of 20° (1 in 2.7) for up to 20m
	A and B combined shall not exceed 2% of the track length	A, B and C combined shall not exceed 5% of the track length	A and B combined shall not exceed 10% of the track length.		A and B combined shall not exceed 20% of the track length	
<b>Guidance</b> <ul style="list-style-type: none"> <li>Any steep uphill sections of trail, are best to occur before or after a flat section or grade reversal. Not at the end of a long section at maximum gradient</li> <li>Trail average gradients of 5.7° (1 in 10) are most sustainable. Trail gradients steeper than this are physically unsustainable, will erode quickly and require a high level of armouring and maintenance to keep to grade.</li> <li>Maximum sustainable trail gradients may need to be less than stated based on a number of environmental factors (see table 2)</li> <li>Trail grade should be reasonably consistent. Where a section is out of grade, it should be no more than 1 grade harder than the target</li> </ul>						

## Descending Trails

Specification	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 Expert	Grade 6 Extreme
<b>DESCENDING TRAILS</b>						
Target Gradient (trail average)	3.5° (1 in 16.3)	5° (1 in 11.4)	6° (1 in 10.5)	10° (1 in 6.3)	14° (1 in 4))	No target
Maximum Gradient	4° (1 in 14.3)	8° (1 in 7)	11° (1 in 5.1)	15° (1 in 3.7)	20° (1 in 2.7)	There is no maximum downhill gradient
Technical Trail Features (jumps, drops, etc)	All features roll-able, no stepped drops	All features roll-able Stepped drops maximum height of 200mm with gentle downhill transitions, and wide "B" lines	All features roll-able. Gap jumps max length 2m Stepped drops max height of 600mm with gentle downhill transitions. Jump ramp angle max 35°	Features mostly roll-able. Gap jumps not rollable must have clearly identified "B" lines. Stepped drops max height of 1m Jump ramp angle max 45°	Features mostly roll-able. Gap jumps not rollable must have clearly identified "B" lines. Stepped drops max height of 1.5m Jump ramp angle max 45°	Trail style will determine type of features. No "B" lines required, but are recommended
<b>Guidance</b> <ul style="list-style-type: none"> <li>Utilise a reverse gradient approach up and over a ridge before turning, rather than turning on a ridge (creating a blind corner)</li> <li>Trail average gradients of 5.7° (1 in 10) are most sustainable. Trail gradients steeper than this are physically unsustainable, will erode quickly and require a high level of armouring and maintenance to keep to grade.</li> <li>Maximum sustainable trail gradients may need to be less than stated based on a number of environmental factors (see table 2)</li> </ul>						



## General Guidance

Specification	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 Expert	Grade 6 Extreme
<b>GENERAL</b>						
Mud	None	Trails can have up to 2% wet and muddy sections. These shall be no deeper than 50mm and should be rideable. To ensure that wet or muddy sections of trail are not excessively long, they should constitute no more than 1m in every 50m			Trails can have up to 2m of mud in every 50m, up to 300mm deep. Riders should typically expect to dismount for these muddy sections.	
Tread Obstacles	None	Up to 50mm	Up to 100mm high	Up to 1m high with bypass	No limit, with bypass	No limit, no bypass
Turn Radius to outside of tread	6m ± 1m	Minimum 4m, 5m minimum desirable	Minimum 2.5m, desirable minimum 3m or more if it is a fast trail.	Minimum 2m, desirable minimum 3m, more if speed is fast section of trail.	Minimum 1.5m, more if speed is desired.	Minimum 1m, more if speed is desired.
Maximum Corner Camber (table 3)	+10deg - 2 degrees Blending to flat inside radius	+ 20 deg – 3 deg Blending to flat inside radius	+40 deg – 3 deg Blending to flat inside radius	No camber restrictions		
Clearances to	<i>Vegetation, Large rocks, Bridge abutments, Sculptures, Power and light poles, Sign posts and perpendicular drains:</i> All shall be cleared a minimum of 0.15m and a maximum of 0.3m from the outer edge of the trail formation and to a height of 2.4m, giving riders a clear passage and an unimpeded view of the surface. Additional clearance of up to 800mm is necessary on bends where riders will lean into corners. 2.0 – 2.4m height clearance may be allowable in some circumstances (ie, bridge abutments, valuable trees, etc).					
Clearances to	<i>Fences, walls, bridge handrails, guard rails, steep slopes, banks and batters, rock faces, parallel drains, lakes, rivers, coastlines, hedges and buildings:</i> All shall be cleared a to minimum of 0.5m and a maximum of 1.0m from the outer edge of the Trail formation and to a height of 2.4 m, giving riders a clear passage and an unimpeded view of the surface.					
Cut /cleared Vegetation Treatment Options	Trees and shrubs should be assessed for their ecological value, and where possible, exotic species removed rather than native species. Trail alignment should be adjusted to avoid removing rare and/or large native trees which are valuable to the landscape and ecological values of the trail.					
	All limbs should be cut flush (or to within 10mm) of the trunk or main branch or ground.					
	All cut woody vegetation shall be removed from the track surface and vegetation <100mm Chipped, vegetation >100mm moved out of site of the track. Note this option is only likely to be suitable for high value scenic reserves, National Parks etc					
	All cut woody vegetation shall be removed from the track surface and, if practicable, out of view of the track, this option is typical for DOC and Council reserves					
Additional Clearances	All cut woody vegetation shall be removed from the track surface and placed beside track to biodegrade, does not have to be out of sight, this option is typical for Forestry Plantations					
	On shared use or 2-way trails, vegetation clearance, especially on corners, shall be sufficient to allow good visibility to a recommended 10m minimum sight distance for cyclists and walkers. Where riding speed is likely to be over 20kph, increase the sight distance to 20m if possible.					
Trail Surface	The surface of the trail shall be well formed, smooth and even and shall be made of durable material, such as concrete, chip seal or asphalt, or compacted top aggregate of 20mm. Wet areas shall be drained. In dry weather the trail surface shall be such that it can be ridden on comfortably without getting wet or muddy	The surface of the trail shall be well formed, smooth and durable. Surface material maybe compacted 30mm aggregate. Wet areas shall be drained. In dry weather the trail surface shall be such that it can be rode on comfortably without getting wet or muddy.	The surface of the trail shall be mostly well formed, even and generally firm. Trails may have some loose sections where the trail surface is broken by rock, roots, scree or other obstacles. These sections shall still provide reasonably good riding conditions in all weather. Wet areas shall be drained. In dry weather the trail surface shall be such that it can be rode on comfortably without getting wet or muddy.	The surface of the trail shall be generally firm but may have some loose sections where the trail surface is broken by rock, roots, scree or other obstacles these shall be no higher/deeper than 200mm. These sections should still provide reasonably good riding conditions in all weather.  Wet areas shall be drained. In dry weather the trail surface shall be such that it can be rode on comfortably without getting wet or muddy.	The trail surface will be highly variable and shall generally be the natural surface and may include mud, water, roots, ruts and embedded rocks. Major obstacles such as windfalls are to be removed or the track diverted around them. Generally minor obstacles such as rocks, tree roots and earth are not to be removed.  The surface of the trail <i>may be</i> firm, loose and have muddy sections. There will be steep climbs with unavoidable obstacles on a narrow trail. Many roots and ruts up to 0.6 m high or deep. The trail surface shall be mostly well formed and even with wet areas drained Up to 50% of the total length of track may have:  (a) short wet or muddy sections or (b) uneven or rough sections where the trail surface is broken by rock, roots, scree or other obstacles. These sections must still provide reasonably good riding conditions in all weather.	
		Some rocks, roots, ruts that can either be avoided, or are less than 50mm high.				

## General Guidance

Specification	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 Expert	Grade 6 Extreme
Environmental Consideration	<ul style="list-style-type: none"> <li>Check local council rules, building consent requirements etc, any local planning restrictions/constraints and Resource Management Act requirements before design and construction</li> <li>Earthworks machinery, hand tools and PPE should be cleaned before being brought on to site to avoid importing weeds</li> <li>In native forests, and close to waterways, extra care needs to be taken to avoid soil erosion and sediment entering streams. Close to waterways, sustainable trail construction involves compacting dug soil on the side of the track so that it doesn't wash to streams. Berms and trail gradients will be more gentle, to avoid soil erosion</li> <li>Plant grass or native vegetation alongside the edge of the track as soon as possible after construction, so as to stabilise the edges and reduce visual impact. This may involve replanting plants that have been dug from the trail alignment during construction.</li> <li>Imported gravel, soil and armouring materials must be from any weed-free source.</li> <li>Survey tags, left over construction materials/signs, spray painted marks and general rubbish should be removed at trail completion.</li> <li>A formal safety audit should be completed at trail completion, including assessing the safety of potential fall zones</li> </ul>					
The minimum structure width shall be	1.2m with handrails/barrier to fall or 1.5m for boardwalks without handrails/barrier to fall. The approach to the structure for at least 10m should be the same width as the structure	1.2m. The approach to the structure for at least 10m should be the same width as the structure	0.9m with handrails /barrier to fall and 1.2m without.	0.6m	0.4m	0.2m
Boardwalks (no handrails or barrier to fall) Width depends on the length, and the height of fall. Measurement not including kickboards.	The minimum boardwalk width shall be 1.5m. Boardwalks shall be used over wet, swampy, sandy or muddy sections to achieve a stable dry surface for visitor comfort and/or to protect the environment.	The minimum boardwalk width shall be 1.2m. Boardwalks may be used over wet, swampy, sandy or muddy sections of the trail to achieve a mainly dry surface and/or protect the environment. Alternatives to boardwalks, such as drainage of wet areas or raised, hardened sections of track, may also be used	The minimum boardwalk width shall be 0.9m. The approach to the structure for at least 10m should be the same width as the structure	The minimum boardwalk width shall be 0.6m. The approach to the structure for at least 10m should be the same width as the structure	Boardwalks are not generally provided on grade 5 trails. Instead where muddy, sandy or swampy conditions exist tracks are to be drained, rerouted or raised. If there is no alternative, boardwalks may be constructed only where they are necessary to mitigate significant environmental effects. Minimum 0.4m for Grade 5, 0.2m for Grade 6	
Bridges (Flared handrails or barrier to fall required to provide handlebar clearance)	All major watercourses shall be bridged. Minor watercourses should also be bridged, except where culverting may be more appropriate.	Watercourses with less than 100mm of water in normal flow and can be easily ridden shall not have bridges; all other watercourses shall be bridged. Culverts may be utilised where appropriate.	All major and minor watercourses shall be bridged except fords with less than 200mm of water in normal flow. The minimum bridge width shall be 0.9m. The approach to the structure for at least 10m should be the same width as the structure. Culverts may be utilised where appropriate	All major and minor watercourses shall be bridged except fords with less than 300mm of water in normal flow. The minimum bridge width shall be 0.6m. The approach to the structure for at least 10m should be the same width as the structure Culverts may be utilised where appropriate	Water courses shall be bridged where they cannot be safely crossed without the help of others during times of normal water flow. Watercourses shall also be bridged where: (a) No reasonable alternative wet weather track exists; and (b) They cannot be safely crossed unassisted when in flood; and (c)Floods occur with a frequency that means the water course is a barrier to progress or becomes a significant hazard and (d)There is no accommodation/shelter within 2 hours riding distance where visitors can wait until the river/stream conditions improve	

## General Guidance

Specification	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 Expert	Grade 6 Extreme
Guardrails / barriers	Where a significant hazard (such as bluffs) exists and there is no other alternative, a barrier or guardrail shall be provided. Barriers and guardrails shall extend for the full length along which the significant hazard exists.					
Viewing platforms	Viewing platforms may be provided in appropriate places along the trail.			Viewing platforms <i>shall not</i> generally be provided on these trails.		
Steps	No 'Walking' Steps, No Stiles		'Walking' Steps are undesirable, however may be used as long as less than 1% of track length			
Shelters & Toilets	Shelters may be provided where there is a significant level of exposure to adverse weather conditions on the most distant parts of the trail. Where shelters are provided, toilets should also be provided at those locations that are popular stops. Toilets should ideally be provided at an interval of not less than 15 km and not greater than 20km apart.					
Furniture	Seats and picnic tables may be provided.			Seats and picnic tables are not generally provided on these trails.		
Signage	Ideally include riding times, distances and grid references at entrances, exits and at all junctions. Significant points of interest along or at the end of the trail should be signposted. At locations where there is a jump to a higher grade, signs shall be provided with appropriate symbols and words to describe the change. An orientation/track information sign should be provided at entrances where more than one riding option exists.					
Trail Type	It's helpful for trail signage to show the trail type: "Technical" typically mean slow speed, rough rooty/rocky surface. "Flow" typically means high speed, smooth surface jumps, rollers and berms.					
Shared Use Trail Signage	The trail shall be clearly labeled as one suitable for pedestrians and cyclists by use of appropriate symbols at track entrances and junctions. At junctions where the trails change from dual use to only walking or off-road cycling there shall be appropriate symbols to inform the user					
Guidance	One of the most difficult sections of trail should be at the start, to act as a 'gateway' or 'filter' that deters riders with not enough skill. Difficult sections should be no more than one grade harder than the overall trail grade. The safest tracks are 'grade consistent'.					



## Guideline for the Provision of Barriers beside Tracks and Structures (based on SNZ HB 8630:2004)

Measure Fall Height Hf 1.5m out from edge of track, or structure that is <1.5m high, for structures that are between 1.5 and 2m high measure Fall Height at the same distance out from the structure as it is high, For Structures >2m high, measure Fall Height 2m out from the structure edge.	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 & 6 Expert & Extreme
Fall onto a benign surface presenting features that will tend to reduce the effect of impact (a) Deep moss (b) Soft vegetation (c) Shallow still water deep enough to cushion a fall (d) Swamp	Hf > 2.0m Provide Type A Barrier Hf = 1.0-2.0m Provide Type B barrier Hf < 1.0m no barrier	Hf > 3.5m Provide Type A Barrier Hf = 2.0-3.5m Provide Type B barrier Hf < 2.0m no barrier	Hf > 2.0m Provide Type B Barrier Hf < 2.0m no barrier	Hf > 2.5m Provide Type C Barrier Hf < 2.5m no barrier	Hf > 3.5m Provide Type C Barrier Hf < 3.5m no barrier
Favourable surface presenting features that neither reduce nor amplify the effect of impact (a) Gravel (b) Sand (c) Deep water with reasonable means of exit (d) Grass	Hf > 1.5m Provide Type A Barrier Hf = 0.5-1.5m Provide Type B barrier Hf < 0.5m no barrier	Hf > 3.0m Provide Type A Barrier Hf = 1.5-3.0m Provide Type B barrier Hf < 1.5m no barrier	Hf > 1.5m Provide Type B Barrier Hf < 1.5m no barrier	Hf > 2.0m Provide Type C Barrier Hf < 2.0m no barrier	Hf > 3.0m Provide Type C Barrier Hf < 3.0m no barrier
Unfavourable surface presenting features that will tend to amplify the effect of impact (a) Jagged stones (b) Concrete pavement (c) Deep water without reasonable means of exit (d) Sharp vegetation	Hf > 1.0m Provide Type A Barrier Hf < 1m Provide Type B Barrier	Hf > 2.5m Provide Type A Barrier Hf = 1.0-2.5m Provide Type B barrier Hf < 1m no barrier	Hf > 1.0m Provide Type B Barrier Hf < 1.0m no barrier	Hf > 1.5m Provide Type C Barrier Hf < 1.5m no barrier	Hf > 2.5m Provide Type C Barrier Hf < 2.5m no barrier
Hazardous surface presenting features that will result in serious harm, regardless of the effect of fall to the initial impact point (a) Swiftly flowing water without means of exit (b) Boiling mud or water (c) Extended falls arising from rolling or sliding, following initial impact, on terrain whose slope exceeds 35deg. Mitigating factors such as vegetation likely to arrest rolling shall be taken into account when assessing extended falls	Provide Type A Barrier	Provide Type A Barrier	Provide Type B Barrier	Provide Type C Barrier	Provide Type C Barrier

**Note 1:** The above table is derived from SNZ HB 8630:2004 and assumes that the walking user groups identified translate to the MTB trail grades 1-6.

**Note 2:** For tracks and structures with tread width <1.2m it's recommended that barriers be angled outwards at approx. 5 deg from vertical to allow clearance for handlebars

**Note 3:** For structures <1.5m in height and not requiring building consent, the following linked references provide ideal construction information and templates: [WCC Description](#) and [Frame Group Drawings](#)

### Barrier construction

#### 1. Type A Barriers

If openings are present, they shall be small enough to prevent a sphere of 100 mm diameter or greater passing through. Barrier components that are between 150 mm and 760 mm above the deck (or stair nosing) shall be constructed to prevent toe-holds from being obtained. The triangular opening formed by the riser, tread and bottom rail at the open side of a stairway shall be constructed so that passage by a 150 mm diameter sphere is prevented.

#### 2. Type B Barrier

Openings in type B barriers shall have maximum dimensions of either:

- 200 mm horizontally between vertical balusters, or
- 300 mm vertically (between intermediate rails) with any openings less than 150 mm between the deck and first horizontal rail.

#### 3. Type C Barrier

Any openings in type C barriers shall have a maximum dimension of 500 mm vertically (between intermediate rails). There is no maximum dimension between vertical sections.

**Table 1 Grade Reversal (Tread Length Management)** Ref: Natural Surface Trails by Design, Troy Scott Parker, 2004

Substrate	Tread Grade										
	0°	1.1°	2.3°	3.4°	4.6°	5.7°	6.8°	8°	9.1°	10.2°	11.3°
Clay loam with high quantity of gravels, stones	65m	49m	37m	27m	20m	15m	11m	7m	5m	2m	2m
Gravelly clay	55m	40m	29m	21m	15m	10m	7m	4m	2.5m	1m	
Loam with high quantity of gravels, stones	49m	36m	25m	17m	12m	8m	5m	3m	2m	1m	
Clay	44m	32m	23m	16m	10m	7m	4m	2m	1m		
Loam	41m	27m	17m	11m	7m	4m	2m	1m			
Crushed granite or limestone, with angular particles 20mm, 125mm thick	38m	24m	15m	9m	5m	3m	1m				
Organic soil	34m	21m	12m	7m	4m	2m					
Sand	30m	17m	9m	5m	2m	1m					

**Notes:**

1. Tread length stated is the distance between a tread crest and the adjacent dip.
2. These values are designed to minimize tread maintenance and minimize tread shape change through erosion
3. Values reflect high splash erosion (no tree canopy)
4. Assumes severe rainfall events of 1-3 times per year. Higher rainfall areas should use shorter tread watershed distances.
5. No tread should have a 0° grade – this column reflects tread grades between 0 and 2°
6. Compacted pure clay while cohesive even on steep grades when dry, is generally too slippery when wet to be practical.

**Guidance Notes:**

- Grade reversals should be placed at all unbridged water crossings, and at all points where water will flow in heavy rain.
- Grade reversals are also useful for slowing riders down before switchbacks and track junctions.



Photography by visualsby.me

**Table 2 Factors Influencing Maximum Sustainable Trail Gradient**

<b>Half Rule</b>	Gradient should not exceed half the grade of the sideslope – if it does, it is considered fall-line.
<b>Soil Type</b>	Some soils will support steeper grades than others – knowing the cohesion and drainage properties of the soil is important
<b>Rock</b>	Solid rock trails will support steeper grades.
<b>Annual Rainfall</b>	Very high and very low rainfall areas may need to be designed with gentler grades
<b>Grade Reversals</b>	Frequent grade reversals will allow for slightly steeper grades
<b>Type of Users</b>	Walkers and Mountain bikers are generally low impact users. If high impact users share the trail, more gentle grades should be considered
<b>Number of Users</b>	High use trails may need more gentle grades
<b>Difficulty Level</b>	Grade 4-6 trails with a desired higher difficulty level may be steeper, but techniques such as frequent grade reversal and tread armoring may be essential to ensure sustainability

**Table 3 Ideal Camber Angles for Berm Style Corners**

Speed into Corner km/hr	2m turn radius	3m turn radius	4m turn radius	5m turn radius	6m turn radius
	degrees				
5	11	6	4	3	2
10	21	15	11	9	7
15	42	31	24	19	16
20	58	46	38	32	28
25	68	59	51	45	39
30	74	67	61	55	50
35	78	73	67	63	58
40	81	77	72	68	65
45	83	79	76	73	69

**Key**

Grade 1 <20 degrees maximum
Grade 2 <35 degrees maximum
Grade 3 <58 degrees maximum
Grade 4 <70 degrees maximum
Grade 5 <80 degrees maximum

**Notes:**

- Human powered bike climbing speeds (on singletrack) are typically 5-10km/hr
- E-bike (<300W) climbing speeds (on singletrack) are typically 10-15km/hr
- Descending speeds vary but typically speed increases with grade
- Designers need to make an assessment or trail speed into a corner to determine berm/camber/radius requirements

**Guidance Notes:**

- Select locations for turns where there is room for a reasonable turn radius while minimizing the requirement for excavation and retaining walls
- Trail gradient through the turn should match the overall trail gradient, as shown in the following table:

Turn Radius (m)	Average Trail Gradient (degrees)				
	3.5	5	6	10	14
	Trail Drop (m) – entry to exit for 180 degree turn, measured at centre of ride line				
2	0.4	0.5	0.7	1.1	1.5
3	0.6	0.8	1.0	1.6	2.3
4	0.8	1.1	1.3	2.2	3.0
5	1.0	1.4	1.6	2.7	3.8
6	1.2	1.6	2.0	3.3	4.6

**Key**

Grade 1
Grade 2
Grade 3
Grade 4
Grade 5



Concession ref:

DOCCM: [DOC-6789733](#)

27 September 2021

Nigel Kerr - Coronet Peak Ski Area Manager

NZSki Ltd

PO Box 359, Queenstown

Dear Nigel

**RE: Application for construction of the Upper Rude Rock bike trail, Coronet Peak Recreation Reserve**

Thanks for your email on 8 June 2020, and for providing one of your team to host the Department's Brian Rance and Lisa Nilsen on 20 May 2021 to walk the alignment of your proposed Upper Rude Rock bike trail.

The Department acknowledges the previous 2005/2006 authorisation to construct this trail, formerly known as the 'Upper Cross Country' trail.

Your proposal is approved, subject to the following conditions:

- a. Trail alignment, construction methodology, revegetation and any other works must be undertaken as per the email application from Nigel Kerr to DOC (Lisa Nilsen) on 8 June 2020. Prior approval must be sought for any changes to these designs and methodologies.
- b. Works should only be undertaken by contractors experienced in mountain bike construction in fragile alpine environments.
- c. Any equipment brought onto the reserve is checked and will be weed and pest free.
- d. Work must be immediately stopped and Heritage NZ/DOC contacted if archaeological material is discovered during any earthworks.
- e. Trail alignment and works must avoid all areas of dense snow tussockland, native shrubland, wetland/seepages, tarns and rocky areas. The trail design should maximise the opportunity to utilise areas of previously modified terrain (in preference to undisturbed vegetation).
- f. Trail width must not exceed 1m, as per trail construction guidelines for a Grade 4 trail. Trails must be constructed to meet MBIE's NZ cycle trail design standards.
- g. The machinery to be used should be specified and confirmed to be appropriate. (i.e. a size that minimises the disturbance corridor). Trail will be shaped by machine and hand.
- h. The trail construction should seek to minimise the width of the corridor of disturbance and the width of the trail.
- i. The trail design should seek to minimise the sediment runoff both during construction and ongoing use.
- j. The trail design should seek to minimise the distance of cushionfield/fellfield vegetation.
- k. Top soil and vegetation will be stripped back and stored to one side, taking care to get plants in a single bucket load.
- l. Vegetation will be replaced by machine and hand onto berms and edges.
- m. Where necessary tussocks only may be split by hand before replanting. All roots must be hand checked as fully buried.
- n. No exposed dirt will be left on the edges of trails.
- o. Complete trail and restoration every 150m to avoid having long exposed sections.

- p. The natural environment of the work sites must be rehabilitated in accordance with the current protocol and to minimise visual impacts to the landscape there should be no steep unvegetated batters left facing out towards the Wakatipu basin.
- q. If there is insufficient salvaged indigenous vegetation, then there should be planting of locally sourced nursery grown, site-appropriate native species. In addition, there should be seed sowing between the clumps of salvaged material. Should vegetation run short this must be noted and added to Coronet Peaks spring / autumn planting.
- r. The concessionaire must ensure the public understands and has knowledge that the use of the trail is the designated place for MTB and avoid conflicts between different users.
- s. The Upper Ride Rock trail will not impinge on other users' access nor enjoyment of the Coronet Peak reserve.
- t. The new trail must be maintained actively.
- u. All approved works must be completed by 1 May 2022, as per the standing protocol, and early decisions need to be made to suspend works unlikely to be completed in time.
- v. Hours of work are Mon – Sat, 7am – 6pm. If work is required on Sunday between the hours of 7am to 5pm, the Concessionaire must seek prior approval from the Grantor (email acceptable) no later than 5pm Thursday, on a weekly basis.
- w. Photographs must be taken pre- and post-works and supplied to the Department, and your chosen independent monitor must arrange the necessary pre- and post-works field inspections, to be documented in regular reports supplied to the Department.
- x. This approval will not supersede any other lawfully required consents, approvals and assessments from other agencies. This includes (but is not limited to) geotechnical, engineering, district and regional resource consents, and building consents. Copies of these approvals, if required, are to be provided to the Department prior to works commencing.

If you have any queries regarding this approval, please don't hesitate to contact Lisa Nilsen on [REDACTED] or [REDACTED]

Yours sincerely

[REDACTED]

David Butt  
Operations Manager - Whakatipu Office  
Pursuant to delegated authority

Department of Conservation - Te Papa Atawhai  
Whakatipu-wai-Māori /Queenstown Office  
PO Box 811, Queenstown 9348  
[www.doc.govt.nz](http://www.doc.govt.nz)



# Coronet Peak MTB Masterplan application

## *Suggested terms and conditions*

25.05.2022

Location            Coronet Peak Recreation Reserve

## Applicants

Coronet Peak

Acknowledging that Queenstown Mountain Bike Club (QMTBC) and Queenstown Trails Trust both have a vested interest in the management of MTB trails in the district and Coronet Peak specifically.

## Attachments

- A. Southern Land overlay of ski area map with all trails marked, graded and measured.
- B. NZ MTB Trail grading and building guidance
- C. CP conditions for trails 27.09.21 DOC 6789733
- D. CP Masterplan proposed conditions
- E. Coronet Peak MTB Flyover bridge (x trail)
- F. Coronet Peak MTB stream bridge (x water)

## Reason for application

Coronet Peak has been home to several MTB trails since at least 2005. The mountain has operated lift access for the purposes of MTB intermittently since summer 2005/6. Since the summer of 2019/20 this was put on a more permanent basis and extended to a four month duration as part of developing better mixed recreational use of the mountain and its facilities.

The summer business levels have built up despite Covid restrictions and while MTB is only part of the recreational use Coronet Peak see's this as a key plank in the business strategy. It also parallels recreational growth and interest in MTB throughout the Wakatipu basin and New Zealand.

In summer 2021/22 Coronet Peak constructed the Upper Rude Rock trail approved initially in 2005. This was undoubtedly a catalyst in showing how much interest there is in MTB in the area.

It would be fair to label Coronet Peak as the apex of a steadily expanding network of trails. Over the last two years we have added the Coronet Loop (Queenstown Trails Trust), Hot Rod (QMTBC), Mt Dewar trails (Treespace) and Upper Rude Rock (Coronet Peak). In addition the QMTBC has refreshed Pack, Track n Sack & Zoot. A lower Zoot and Hot Rod link track from Rude Rock are being built currently. There is no doubt that mountain biking is becoming increasingly popular both domestically and internationally. Having the recreational reserve as part of the wider trail network on this side of the basin will make full use of the supporting infrastructure and facilities that are available.

In order to complete the recreational transition of Coronet Peak to a MTB hub a Masterplan has been produced which will allow the full impact of future MTB development to be assessed.

## The intended outcome

The range of trail grading intended to be built at Coronet Peak are from Grade 2 to Grade 6. This is to cater for the widest possible range of visitors.

The network proposed also allows access through the DOC reserve down towards the valley below for a range of trail grades to complete the development of the Coronet Peak face. These trails will need separate LINZ approvals and be partnered with either QMTBC or the Queenstown Trails Trust.

In most cases shorter infill trails link the descents together to create variation and also spread the traffic out. This is safer and allows for better maintenance.

Aspirational. The World Cup route is exactly that. Designed to run a UCI World Cup no sooner than 2025 in Queenstown. Bringing the best riders in the World to New Zealand and giving Queenstown the badge to add credibility to our offering.

### SCOPE of works

Name	Grade	Status	Length (m)
Coronet DH	Grade 5: Expert	Existing	1859
Coronet XC	Grade 3: Intermediate	Existing	2799
Rude Rock Link	Grade 4: Advanced	Existing	397
Upper Rude Rock	Grade 4: Advanced	Existing	3293
Cold Play	Grade 6: Extreme	Proposed	330
Freewheeler	Grade 5: Expert	Proposed	538
Ka Kite Ano	Grade 3: Intermediate	Proposed	3508
Kids Loop	Grade 3: Intermediate	Proposed	222
No THYME	Grade 6: Extreme	Proposed	783
Oblivion	Grade 4: Advanced	Proposed	833
Tally Ho	Grade 4: Advanced	Proposed	551
Velvet Rolls	Grade 3: Intermediate	Proposed	596
Way Wide	Grade 3: Intermediate	Proposed	869
Whakatipu View	Grade 2: Easy	Proposed	3232
Whee	Grade 2: Easy	Proposed	229
World Cup	Grade 6: Extreme	Proposed	1847

2400m Grade 2 is being applied for separately to this application as a short term build. However in this application it should be considered as part of the sum effect.

4570m lineal length of trails graded 3 through 5 within the Coronet Peak Rec reserve in areas bounded by existing ski activity.

2177m lineal length Grade 6 suited for World Cup events and experienced riders.

4291m lineal length of trails that drop below the existing area extensively modified by ski activity onto the Coronet face and into the LINZ administered area.

### Methodology

Please refer to the attached documents. The details below are specific to trail building in the Coronet Peak Recreation Reserve.

Secondly ongoing maintenance shall rest with Coronet Peak over summer with regular hand maintenance which is currently built into the work force plan.

Firstly some wider environmental concerns.

1. For trails graded 2 through 4 the preferred digger size is 1.7T.
2. For trails graded 5 through 6 the preferred digger size is 3T, maximum 5T to allow for an extended reach and easier to place heavier objects.
3. Trail construction should be paused from 1 January – Mid March as revegetation of trails is not feasible in the dry period of summer.
4. Seasonal Trail construction should be completed by 30<sup>th</sup> April due to the ground freezing up.

5. The GIS mapping is a Development pathway. It needs to be recognised that the trail will be built in a similar alignment but not exactly on the line shown. This can be confirmed by 'as built' mapping and overlay post construction.

#### Specific conditions

6. We suggest the start point should be the conditions attached from DOC6789733.
  - a. With changes suggested below to item f plus a few suggested additional conditions.
7. *Culverts installed in any effermeral gullies or areas where water might run. Use rock rip rap to slow down the speed of water around these where necessary.*
8. *Bridges installed over any permanent water flows.*
9. *A minimum of one man day should be matched to every digger day for revegetation work as the trail is built.*
10. *Trail width guidelines (item f)*
  - a. *Grade 2 800-1200mm*
  - b. *Grade 3 800-1400mm*
  - c. *Grade 4 800-1600mm*
  - d. *Grade 5 800-1800mm*
  - e. *Grade 6 1000-1800mm*
  - f. *Trail width varies along a trail and is greatest at obstacles and corners. Less than 5% of the trail length should exceed the ranges above being wider bermed corners or at obstacles where a 'B' line is installed.*
    - i. *B lines are most frequent at Grades 2-4.*
    - ii. *Larger bermed corners on the faster Grade 4 – 6 trails.*
11. *Where bridges are utilised for either trail or water crossings they shall be built and inspected to the satisfaction of a Civil Engineer. Drawings attached.*
12. *The GIS mapping is a Development pathway. The actual trail shall be built up to five metres either side of the line staying away from any areas recognised as sensitive. This includes wetlands, faefel and Lichen.*
13. *The World Cup trail is a route rather than a flow trail. For this reason we would propose some unique conditions.*
  - a. *Many of the routes between features could be 'buzz cut' down to just above ground level. Leaving the original vegetation embedded while creating good visibility for the rider. This is a rougher surface to ride in line with this level of trail but less environmentally damaging.*
  - b. *Another feature that would be built in places is removing the vegetation and replacing with large rocks to be ridden along the line of the trail creating a hard surface less likely to be damaged by water or bikes.*

In assessing the effects of the building of these mountain bike trails the following considerations were considered within the Coronet Peak Recreational Reserve.

#### Earthmoving

The actual disturbance created varies dependent on the alignment of trail and steepness of the slope. Not all the length of trail requires movement as has already been noted for the 'Wakatipu

View' trail. Parts of trails where possible have utilised existing snowmaking pathways which minimises environmental impacts.

Assuming 1 metre trail width on a 30% slope there is  $1/3m^3$  of earth moved to create a berm of similar for every lineal metre of trail. It is all cut and fill construction with the cut moved no more than a few metres in any direction.

So we can assume a maximum of  $3000m^3$  of disturbed earth over the length of the trails proposed within the reserve. Bearing in mind the World Cup is not a Flow trail so is not cut into the hill except in key corners. And a further  $1400m^3$  below the ski area for the Thyme Out and Ka Kite ano trails.

It is considered that the overall effects are minimal and can be sufficiently mitigated.

Secondly it is not proposed that all these trails will be built at one time. Up to 3000m of trails built per summer would be substantial and within the capacity of the ski area to rehabilitate. Much more would need careful consideration.

The effects will be restricted to a small area given the altitudinal range across which the trails are proposed to be built. A lot of thought has been put into the alignment of the trails to minimise disturbance across sensitive parts of the reserve. Ongoing monitoring through construction will be an added directive to achieve the highest outcomes.

### Re vegetation

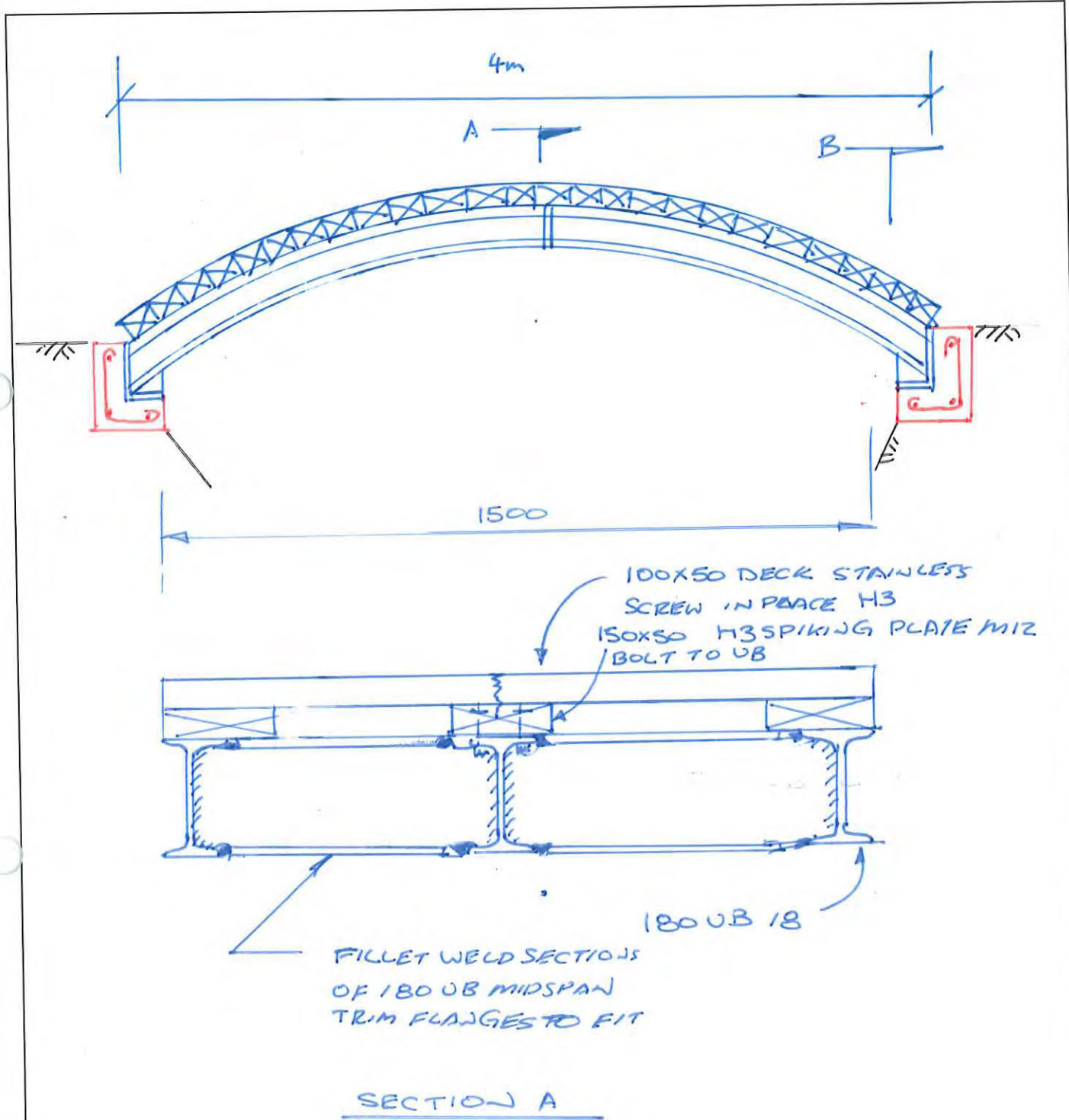


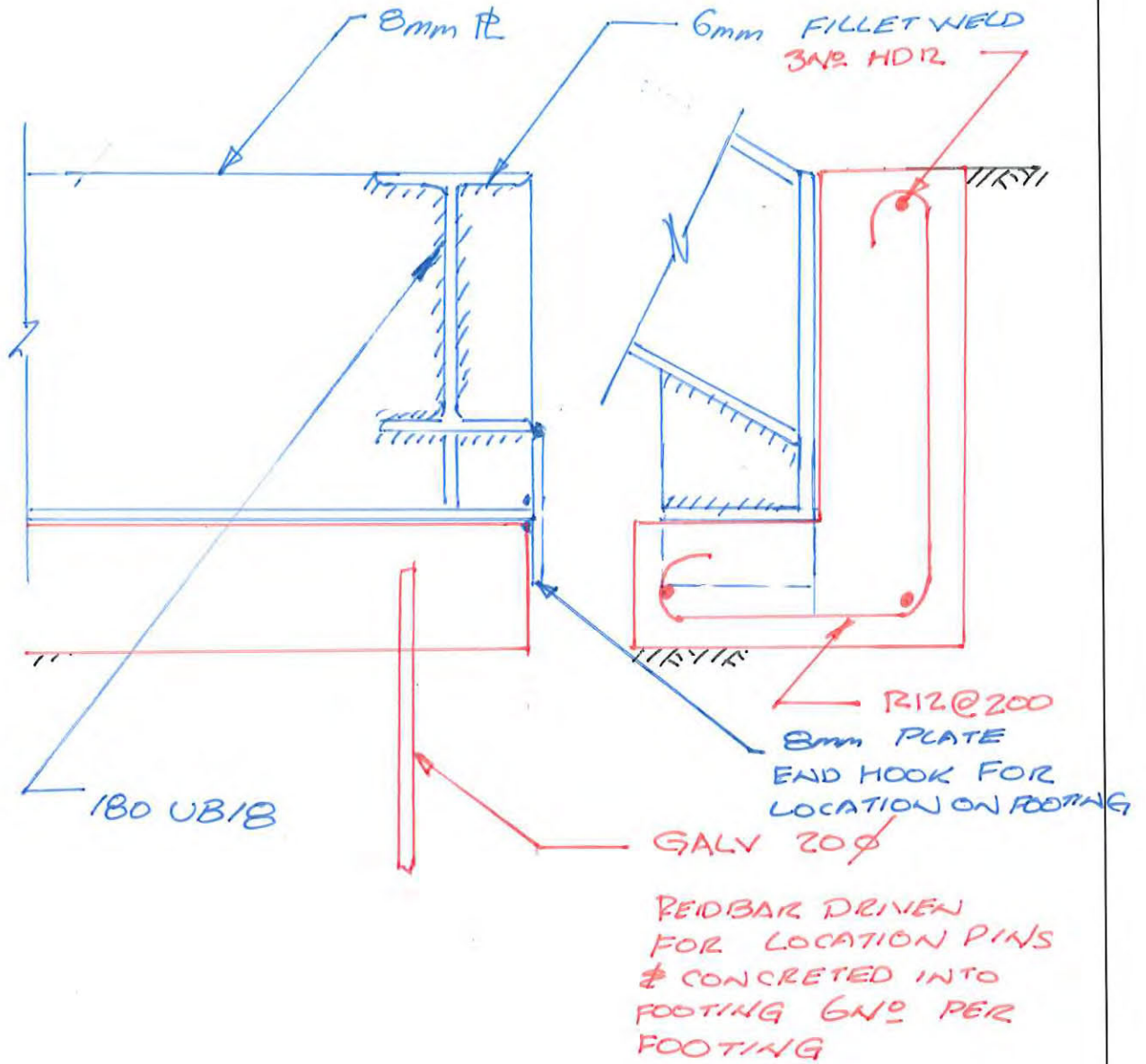
It is important to remember at higher altitudes successful restoration of the environment takes years. However within the reserve there is now the Upper Rude Rock trail built in the last year by small digger and revegetated by hand to give an understanding of the immediate effect. And the XC trail which has had to be refreshed this year but original works were in 2005. Grade 4 Upper Rude Rock Link Trail following hand revege and additional replanting alongside the trail.

Good regular maintenance is focused on ensuring the trail width and shape is maintained – especially in berms.

Secondly to ensure water tables are maintained and working well to reduce

the incidence of water channelling the MTB trail.





SECTION B

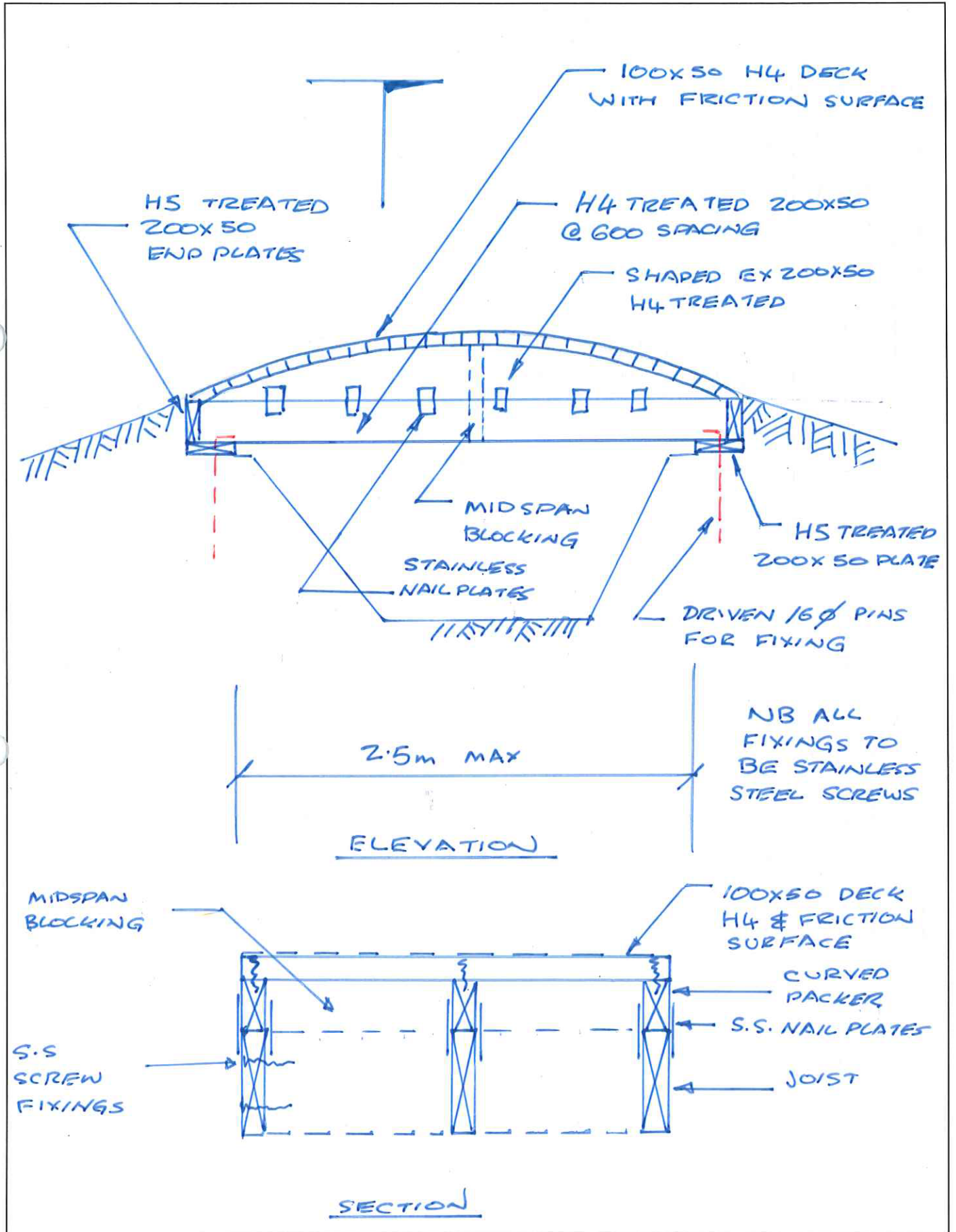


Table 7.1 – Floor joists – SG 8 up to 2 kPa floor loads (see 7.1.1.1)

(a) 1.5 kPa floor load SG 8 (dry in service)			
Floor joist size	Maximum span* of joists at a maximum spacing (mm) of:		
	400	450	600
(mm x mm)	(m)	(m)	(m)
90 x 45	1.45	1.40	1.25
140 x 35	2.10	2.00	1.80
140 x 45	2.70	2.60	2.00
190 x 45	3.55	3.45	3.15
240 x 45	4.40	4.30	3.90
290 x 45	5.20	5.05	4.60
(b) 2 kPa floor load SG 8 and SG 8 (Wet) (wet in service)			
Floor joist size	Maximum span* of joists at a maximum spacing (mm) of:		
	400	450	600
(mm x mm)	(m)	(m)	(m)
90 x 45	1.60	1.50	1.30
140 x 35	2.20	2.05	1.80
140 x 45	2.50	2.35	2.05
190 x 45	3.40	3.20	2.75
240 x 45	4.30	4.05	3.50
290 x 45	5.20	4.90	4.25

\* Spans may be increased by 10 % for joists continuous over 2 or more spans.

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Treated to hazard class H4	In contact with ground or concrete	Not suitable for critical major structural components in ground contact	CCA Copper quaternary (including micronized copper quaternary) Copper azole (including micronized copper azole)	Fence posts, horizontal timbers for retaining walls
----------------------------	------------------------------------	-------------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------

*JOISTS & DECK*

Treated to hazard class H5	In contact with ground or concrete	Suitable for critical major structural components in ground contact	CCA Copper azole (including micronized copper azole) Copper quaternary (including micronized copper quaternary)	House piles and poles, crib walling, retaining wall poles
----------------------------	------------------------------------	---------------------------------------------------------------------	-----------------------------------------------------------------------------------------------------------------------	-----------------------------------------------------------

*END PLATES.*

## 7. Platforms, decks and bridges

---

### 7.1. Decks, platforms, bridges, boardwalks, etc



A building consent is not required for work on decks, platforms, bridges, boardwalks and like structures where it is not possible to fall more than 1.5 metres.

Note that a safety barrier is still required under Building Code clause F4 – Safety from falling where there is a fall of 1 metre or more.

**i** Always check with your local council to ensure the proposed building work does not have any district planning implications, such as maximum site coverage, yard or setback requirements, daylight access planes and permitted activities. A resource consent may be required and it is important that you obtain this before starting any building work.

## Examples



### What is exempt

1. A farm owner wants to build a short-span bridge over a small creek on their land with a clear span of 5 metres between supports and a fall height of less than 2 metres. The bridge design is undertaken by a chartered professional engineer (structural and geotechnical) and the bridge has capacity signage along with a Building Code complaint barrier. The bridge will only be used by small trucks or small agricultural machinery owned and operated by the farm owner.



### What needs consent

1. A landowner is constructing a small bridge over a river on private land where the bridge is likely to be used by the public or employees of nearby businesses. A building consent is required for this building work as it will be used by members of the public.
2. A horse breeder wants to build a small short-span bridge over a river on private land which will not be used by the public. The bridge span which is the actual total length of deck is equal to 7 metres. A building consent is required for this building work as it spans more than 6 metres.



### What the law says

#### Schedule 1 of the Building Act 2004

#### 47. Short-span bridges on private land

1. Building work in connection with a bridge that—
  - (a). has a span of less than 6 metres; and
  - (b). does not span a road, a railway, or any other area with public access; and
  - (c). is not used by the general public; and
  - (d). has a safety barrier.
2. However, subclause (1) does not apply to a bridge from which it is possible to fall further than 3 metres even if it collapses.

BARRIER NOT REQD  
WHERE IT IS INCOMPATIBLE  
WITH USE SEE F4

# New Zealand Building Code

## Clause F4 Safety from Falling

The mandatory provisions for building work are contained in the New Zealand Building Code (NZBC), which comprises the First Schedule to the Building Regulations 1992. The relevant NZBC Clause for Safety from Falling is F4.

<b>FIRST SCHEDULE—continued</b>	
<b>Clause F4—SAFETY FROM FALLING</b>	
<b>Provisions</b>	<b>Limits on application</b>
<b>OBJECTIVE</b>	
<b>F4.1</b> The objective of this provision is to safeguard people from injury caused by falling.	
<b>FUNCTIONAL REQUIREMENT</b>	
<b>F4.2</b> <i>Buildings</i> shall be constructed to reduce the likelihood of accidental fall.	
<b>PERFORMANCE</b>	
<b>F4.3.1</b> Where people could fall 1 metre or more from an opening in the external envelope or floor of a <i>building</i> , or from a sudden change of level within or associated with a <i>building</i> , a barrier shall be provided.	Performance F4.3.1 shall not apply where such a barrier would be <u>incompatible with the intended use</u> of an area, or to temporary barriers on <i>construction</i> sites where the possible fall is less than 3 metres or to <i>buildings</i> providing pedestrian access in remote locations where the route served presents similar natural hazards.
<b>F4.3.2</b> Roofs with permanent access shall have barriers provided.	
<b>F4.3.4</b> Barriers shall:	
(a) Be continuous and extend for the full extent of the hazard,	
(b) Be of appropriate height,	
(c) Be constructed with <i>adequate</i> rigidity,	
(d) Be of <i>adequate</i> strength to withstand the foreseeable impact of people and, where appropriate, the static pressure of people pressing against them.	
(e) Be constructed to prevent people from falling through them, and	

Amend 2  
Jan 2017



**Coronet Peak Lease  
Application  
Ecological Assessment**

**NZ Ski Limited**

*January 2019*



Arrow Lane Arrowtown 9302  
[www.e3Scientific.co.nz](http://www.e3Scientific.co.nz)

Coronet Peak Lease Application  
Ecological Assessment

Document Status

Version	Purpose of Document	Prepared By	Reviewer	Review Date
0.1	Draft for internal review	MJ, RA, CK	GD	28 Jan 2019
0.2	Draft for client review	MJ	GD	31 Jan 2019
0.3	Draft for client review	MJ	GD	27 Feb 2019
0.4	Draft for client review	MJ	GD	13 Mar 2019
1.0	FINAL	MJ	GD	13 Mar 2019



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# 1 Introduction

## 1.1 Overview

NZ Ski Limited (NZ Ski) is currently seeking a concession with the Department of Conservation for the use of the Coronet Peak Recreation Reserve. In order to support the lease renewal application, NZ Ski commissioned e3Scientific Limited (e3s) to undertake an ecological assessment of the area of recreation reserve to characterise the ecological values of the reserve utilised by the ski field and assess the ecological effects associated with the ski field operation. The boundary and layout of the ski area is presented in Figure 1.

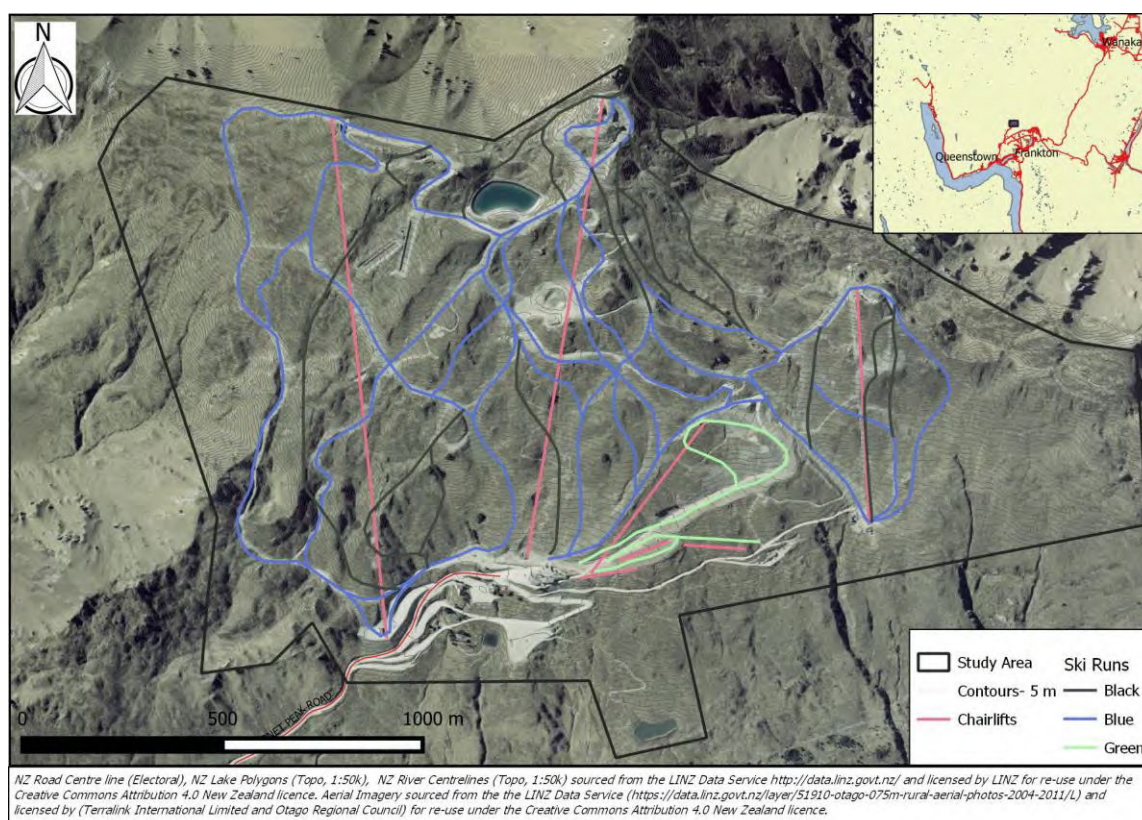


Figure 1: Area of Coronet Peak Recreation Reserve surveyed for this report.



## 1.2 Ecological Report Structure

The report is structured as follows:

- Section 2: Description of the existing natural environment and the historical activities that have occurred on site.
- Section 3: The methodology employed during the ecological assessment.
- Section 4: Description of the flora and faunal values present.
- Section 5: Assessment of the significance of the ecological values.
- Section 6: Ecological Impact Assessment associated with the operation of the ski area.
- Section 7: Recommendations to avoid, remedy or mitigate identified effects.
- Section 8: Future proposals.
- Section 9: Conclusions and recommendations.

## 1.3 Limitations

e3s performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental science profession. No warranties, express or implied, are made. The confidence in the findings is limited by the Scope of Work, and limited data due to the site visits being at one time of year. A full range of biota that are present at this site may not have been seen or recorded, however, desktop research was utilised to aid the assessment.

The results of this assessment are based upon site inspections conducted by e3s personnel, and information provided in scientific literature. All conclusions and recommendations regarding the properties are the professional opinions of e3s personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, e3s assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside e3s, or developments resulting from situations outside the scope of this project.



## 2 Description of the Existing Environment

### 2.1 Environmental Context

The Coronet Peak Recreation Reserve is an alpine reserve situated predominantly over the southern face of Coronet Peak and contains the Coronet Peak Ski Field, which is operated by NZ Ski. The Recreation Reserve is located within the Shotover Ecological District of the Lakes Ecological Region (DOC, 2018). The area for the ecological review is presented in Figure 1 and henceforth referred to collectively as the 'study area' or as the 'Reserve'. The entire extent of the Reserve is located in the lowest threatened environment category (Landcare Research, 2019) with the indigenous vegetation cover exceeding 30% of its original extent and greater than 20% formally protected for natural heritage values.

#### 2.1.1 Historical Context

In the late 19th century the Reserve land that is used by NZ Ski was part of Coronet Peak Station, a large amalgam of several pastoral leases and other rural properties. Coronet Peak Station is located between the Shotover and Arrow Rivers, stretching roughly from the foothills of Coronet Peak in the south, to Mount Hyde in the north (Lake Wakatipu Mail, 1892 and 1923). Around 10,000 sheep were run on the property at any one time, with contemporary accounts describing the land as "well grassed", though it is unclear if this refers to exotic pasture or tussock (Lake County Press, 1894; Press, 1906).

In 1929 an accidental fire is recorded as destroying 2000 acres of 'good winter country' on the station. Intentional tall tussock grassland burning was also presumably undertaken to provide feed for stock on fresh tussock growth and encourage the growth of exotic pasture. This was practiced on neighbouring runs and would have typified the management system for pastoral farming in Central Otago.

The area has historically played host to a range of pests. Rabbits were a particular problem, with numerous historic records emphasising the need for their control (Lake County Press, 1892, 1906; Lake Wakatipu Mail, 1914). However, this still did not dissuade the local Acclimatisation society from releasing hares on Coronet Peak Station in the early 1900s (Lake Wakatipu Mail, 1906). Feral goats also appear



to have been plentiful on the station, with musterers counting “upwards of six hundred on a sunny slope near Long Gully” (Lake County Press, 1914).

Skiing on the Coronet Peak Station begun in earnest by 1939. Newspaper reports from 1939 record people trekking to Coronet Peak itself, and skiing down the hillside to the homestead on Coronet Peak Station Road (Otago Daily Times, 1939). Coronet Peak opened in 1947 as New Zealand's first commercial ski field (Queenstown NZ, 2019). The Reserve was set apart as a reserve for recreational purposes in 1955 and was named the Coronet Peak Recreation Reserve in 1986 (The New Zealand Gazette, 1955 & 1986).

### 2.1.2 Physical Environment

The Reserve area covers a wide altitudinal range from approximately 1000 m near the waste water treatment pond to the top of Coronet Peak at 1651 m above sea level. The geology of the area is Aspiring lithologic association which is very well segregated and laminated; abundant pelitic and subordinate psammitic greyschist with minor greenschist and metachert (GNS, 2014).

The Reserve area includes a variety of topographical and geographical features associated with the hummocky terrain, including hills and depressions of variable sizes and shape, rocky outcrops, tarns and moderately steep sided watercourses and springs (see Figure 2). Modification of the topography has occurred during the construction of the mountain biking trails, ski field trails and associated buildings and snow making equipment.

### 2.1.3 Biological Environment

#### *Flora*

The dominant native vegetation that is present within the Reserve is *Dracophyllum* shrubland mixed with tall tussocks. Other plant communities include cushion fields, fellfield and rocky outcrops, wetlands, tarns, tall tussock grasslands and exotic grasslands. The distribution of the vegetation communities across the Reserve is predominantly in response to the natural variability in altitude, aspect, topography and soil depth. However, disturbance undertaken to support the development of ski trails has resulted in the introduced of exotic grasslands (dominated by browntop) which extends throughout the altitudinal range of the ski field.



The pre-European vegetation would have consisted of either scrub, tussock-grassland and herb field above the tree line grading to scrub, shrubland and tussock-grassland and then to beech forest (Landcare Research, 2019). The beech forests would have consisted of mountain beech (*Fuscopora cliffortioides*) and silver beech (*Lophozonia menziesii*) with mountain totara (*Podocarpus laetus*) and mountain toatoa (*Phyllocladus alpinus*) (Leathwick et al., 2003). By the time Europeans arrived, grassland prevailed throughout the deforested areas, with snow tussock grasslands (*Chionochoa* spp.) dominating at higher elevations. Deforestation mostly occurred soon after Maori arrival (Leathwick et al., 2003). Further modification of the area and vegetation has occurred as a result of farming and ski field activities.



Figure 2: Examples of the terrain within the Coronet Peak Recreation Reserve.



## Fauna

The native bird species that are known to be found in or could use the natural habitats within the Reserve include the New Zealand eastern falcon (*Falco novaeseelandiae novaeseelandiae*), kea (*Nestor notabilis*) and the New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*). The kea is classified as Nationally Endangered, the eastern falcon is At Risk – Recovering, and the pipit is At Risk – Declining (Robertson et al., 2017). Paradise shelduck (*Tadorna variegata*) utilise the constructed snow making water ponds. Small introduced passerine species are also present within the Reserve.

Lizard species that were recorded within the Reserve area included the Not Threatened McCann's skink (*Oligosoma maccanni*) and one At Risk – Declining southern grass skink (*Oligosoma polychroma* Clade 5) (Hitchmough, et al., 2016).

A wide range of invertebrates have been recorded in the Coronet Peak Pastoral Lease (DOC, 2006) area including the alpine zone as well as the Coronet Peak Recreation Reserve, which lies outside the boundary of the Coronet Peak Station. These surveys have recorded 390 species of invertebrates including 289 moth species (DOC, 2006).





## 3 Methodology

The ecological assessment for the area of the Coronet Peak Recreation Reserve that the ski field operates on is based on a desktop study, and site visits completed on 13, 14, 18 and 20 December 2018, 22 January 2019 and 4 March 2019. The scientists involved in the ecological survey work included the following:

- Terrestrial Ecologists – Melissa Jager and Glenn Davis
- Freshwater Ecologist – Dr Richard Allibone; and
- Herpetologist– Carey Knox

### 3.1 Desktop Research and Site Visit

The desktop and site visits included:

- Review of existing ecological information to determine ecological habitats and species likely present on the site; and,
- Site visits to survey the botanical, freshwater, avifauna and herpetofauna values and describe habitats across the ski area.

### 3.2 Assessment of Information

An assessment of the species and ecological habitats present was conducted by undertaking the following steps:

- Establishing the representativeness of the ecological habitats present and significance through a site visit and a review of the expected pre-disturbance vegetation and Land Environments of New Zealand (LENZ) classification (Leathwick, et al., 2003).
- Establishing the presence and significance of plant species through site visits and the Department of Conservation's threat classification for New Zealand vascular plants (de Lange, et al., 2018).
- Establishing the likely presence and significance of native avifauna species through a site visit, existing scientific knowledge and the Department of Conservation's threat classification for New Zealand birds (Robertson, et al., 2017).



- Establishing the presence and significance of invertebrate species through existing scientific knowledge.
- Establishing the presence and significance of lizard species through site visits and previous records in the area from the Department of Conservation's Bioweb herpetofauna database and consideration of the habitat present in the area and its suitability for relevant lizard species.
- Establishing the presence and significance of freshwater invertebrates through existing scientific knowledge and sampling of the invertebrate fauna of the streams and tarns using a 500 µm kick net. Material collected in the kick net was sorted on site with any invertebrates found placed in labelled jars and preserved in 70 % ethanol. A full count of invertebrates collected was completed and identifications confirmed using the keys of Winterbourn & Gregson (1989).



## 4 Ecological Values

### 4.1 Vegetation

The Coronet Peak Recreation Reserve consists predominantly of *Dracophyllum* – tussock shrubland, however other vegetation communities such as cushion fields, wetlands, seepages, rocky outcrops and exotic grasslands are present. The vegetation communities are described below and shown on Figure 3 and Plates 1-7. Exotic weed and grass species were present in all habitats.

#### 4.1.1 *Dracophyllum* - Tussock Shrubland

*Dracophyllum* tussock shrubland is the dominant vegetation present throughout the Reserve (see Figure 3 and Plate 1), however, this vegetation community varies in the composition of the dominant species. For example, above approximately 1500 m asl, *Chionochloa macra* is present rather than *Chionochloa rigida*, which is present over the rest of the Reserve. The elevation at which *C. rigida* replaces *C. macra* is approximately 1500 m, however there is a transition zone where *C. macra* can extend to lower elevations and vice versa.

*Dracophyllum rosmarinifolium*, *Dracophyllum pronum* and *Chionochloa* spp. are the dominant species however there is a diverse range of other indigenous species are also present including *Celmisia lyallii*, *Poa Colensoi*, *Veronica hectorii*, *Ozothamnus vauvilliersii*, *Gaultheria depressa* var. *novae zealandiae*, *Aciphylla kirkii*, *Huperzia australiana*, *Leucopogon fraseri*, *Kelleria childii*, *Pimelea oreophila*, *Geranium brevicaule*, *Raoulia subsericea*, *Anisotome flexuosa*, *Brachyscome montana*, *Ourisia glandulosa*, *Ourisia caespitosa* and *Kelleria dieffenbachii*. At lower elevations *Ozothamnus vauvilliersii*, *Veronica hectorii* and *Gaultheria crassa* become more prominent. *Brachyglottis cassinioides* is also present in patches at lower elevations.



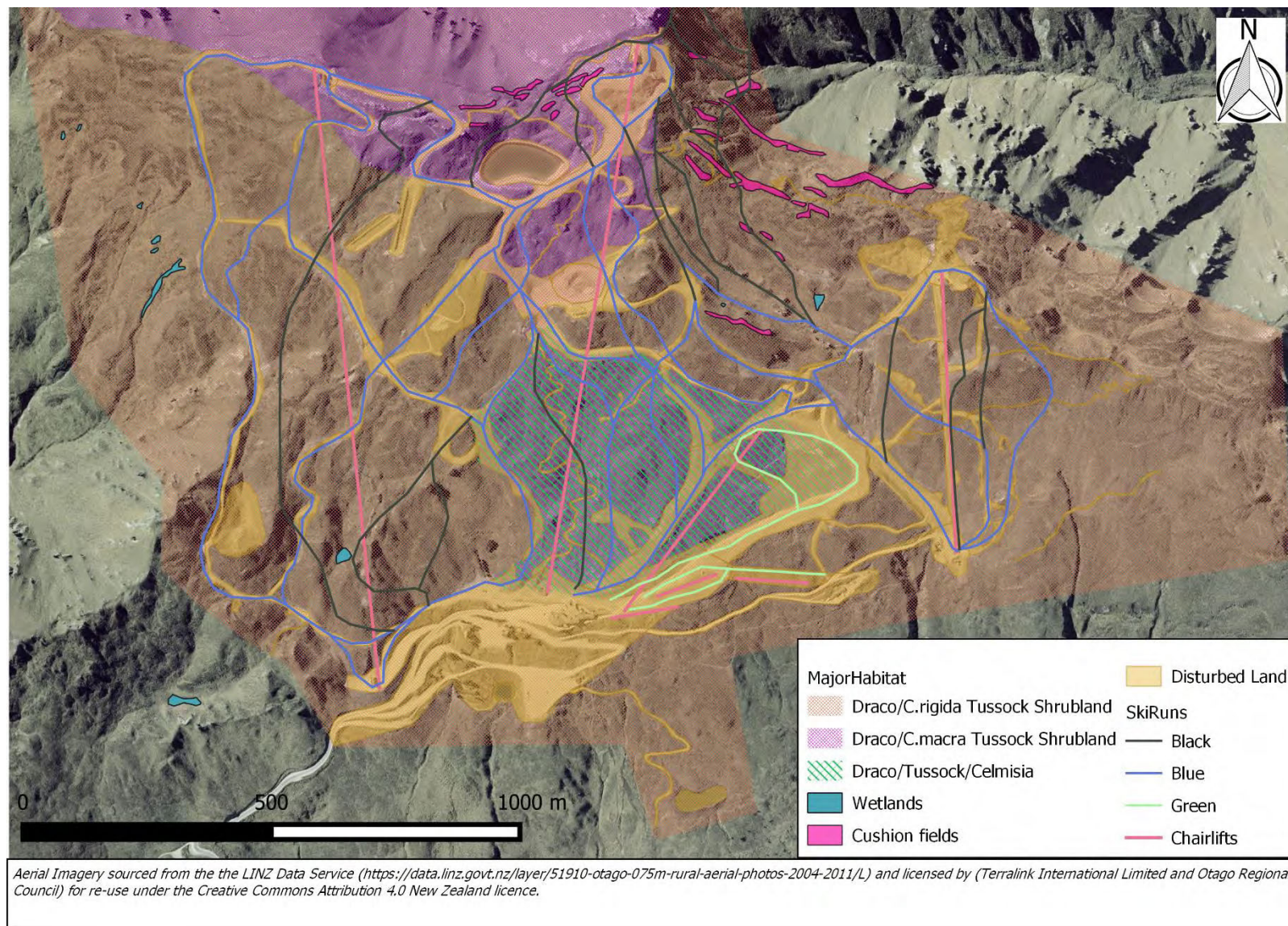


Figure 3: The vegetation communities within the study area and areas of disturbed land.





Plate 1: *Dracophyllum* tussock shrubland across the Reserve.

#### *Dracophyllum* – Tussock - *Celmisia* shrubland

The area of *Dracophyllum* shrubland that is located above the base building and between the main ski trails (see Figure 3 and Plate 2) has a higher proportion of *Celmisia lyallii*. This area is also scattered with blue tussock, snow tussock and *Veronica hectorii*. The increased presence of *Celmisia lyallii* in this area is noticeable, and most likely attributable to the higher level of historic and current disturbance that has occurred.





Plate 2: Co-dominant *Dracophyllum spp.* and *Celmisia lyallii* located near the base building and between the main ski trails.

#### 4.1.2 Rocky Summit

Rocky outcrop plant communities are present in small pockets over the Reserve, however the main area is around the summit of Coronet Peak (see Plate 3). This area has a wide range of species, which is a result of soil depth and exposure. Species found on the rocky summit include *Veronica buechananii*, *Poa colensoi*, *Brachyglottis bellidioides*, *Brachyscome montana*, *Dracophyllum pronum*, *Raoulia hectorii*, *Raoulia subsericea*, *Ourisia glandulosa*, *Ourisia caespitosa*, *Gaultheria depressa* var. *novae-zealandiae*, *Celmisia angustifolia*, *Dracophyllum muscoides*, *Epilobium purpuratum*, *Thamnolia vermicularis*, *Anisotome flexuosa*, *Acaena saccaticupula*, *Lycopodium fastigiatum* and *Luzula pumila*. The rocky summit vegetation incorporates species that are found in the cushion fields (see below) but did have species that were also not widely spread such as *Epilobium purpuratum* which is Naturally Uncommon and the rush, *Marisoppospermum gracile*, which was only present in patches.





Plate 3: Coronet Peak rocky outcrop habitat.

#### 4.1.3 Cushion Fields

The cushion fields within the Reserve are typically found in small, narrow strips on exposed ridges and spurs in the upper elevations of the Reserve (see Figure 3 and Plate 4). These communities have been developed in response to high wind and sun exposure on and relatively shallow soil depths. Species within these communities include *Dracophyllum muscoides*, *Raoulia hectorii*, *Raoulia grandiflora*, *Hectorella caespitosa*, *Poa colensoi*, *Luzula pumila*, *Rytidosperma pumilum*, *Abrotanella inconspicua*, *Ourisia glandulosa*, *Ourisia caespitosa*, *Veronica densifolia* and *Celmisia laricifolia*. Larger species such as *Veronica buchananii*, *Anisotome flexuosa*, *Gaultheria depressa* var. *novae-zealandiae* and *Acaena saccaticupula* are also present.





Plate 4: Cushion field habitat. A and B – Photos showing the location of cushion field habitat along the tops of the exposed ridges and spurs.

#### 4.1.4 Wetlands, Tarns, Streams and Seepages

A number of wetlands are present across the ski area including three tarns, multiple streams and seepage areas (see Figure 3 and Plate 5). The wetlands and seepages vary from cushion wetlands dominated by comb sedge (*Oreobolus pectinatus*) with a range of small herbs and wetland plants to *Schoenus pauciflorus* dominated sedge lands. The wetlands are small in area and predominantly found on the western side of the Reserve. Species present included *Abrotanella caespitosa*, *Ranunculus gracillipes*, *Nertera balfouriana*, *Carex gaudicaudiana*, *Caltha obtusa*, *Coprosma perpusilla*, *Plantago unibracteata*, *Cardamine corymbosa*, *Anisotome aromatica*, *Ourisia caespitosa*, mosses and lichens. *Dolichoglottis lyallii* was found along the stream and seepage margins, and *Coprosma rugosa* at lower elevations along the steep creek banks.







Plate 5: A and B – Small wetlands near the western boundary of the ski field. C – Large tarn. D – Seepage area.

#### 4.1.5 Exotic Species and Habitat

Exotic species are widely spread over the Coronet Peak Recreation Reserve. Exotic species are the dominant vegetation on the ski trails as well as any disturbed ground (see Plate 6). Common weed species present included brown top (*Agrostis capillaris*), white clover (*Trifolium repens*), yarrow (*Achillea millefolium*), sweet vernal (*Anthoxanthum odoratum*), tussock hawkweed (*Hieracium lepidulum*), mouse-ear hawkweed (*Hieracium pilosella*), creeping thistle (*Cirsium arvense*), broad leaved dock (*Rumex obtusifolius*) and sheeps sorrel (*Rumex acetosella*). Brown top and white clover are present within most of the of the vegetation communities but are at low levels in the *Dracophyllum* shrublands to the west of the ski area. Grey willow and wilding conifer seedlings were present, however control of these two species across the Reserve was evident.





Plate 6: A – D Photographs showing the exotic grass habitat associated with the ski trails within the Reserve. E and F – Examples of exotic grasses moving into native habitat.

The regeneration of native species on the disturbed areas such as the ski trails was more evident at higher elevations, where the exotic grass mix was less successful in striking (see Plate 7). The presence of bare soil has enabled native species to colonise disturbed sites. Native species which are spreading over these bare areas include *Raoulia tenuicaulis*, *Acaena saccaticupula*, *Poa colensoi*, *Rytidopserma pumilum*, *Epilobium* spp. In one location the Nationally Vulnerable, small rosette *Myosotis elderi* was present (see Plate 7). In the lower elevations, such



as on the Big Easy trail, where the exotic species have formed a thick cover, regeneration of native species is much lower (see Plate 7).



Plate 7: A – Exotic grass mix forming thick cover at lower elevation. B – Exotic grass mix seeding showing bare patches at higher elevation. C – Example of native regeneration coming through exotic grass mix at higher elevation where exotic seeding has not been successful. D – *Myosotis elderi* on exposed ground where exotics have not yet established.



## 4.2 Freshwater

The sampling was conducted during rainy weather during an extended period of wet weather. Therefore, the flows observed in this survey are expected to be relatively high and not representative of summer low flow conditions. It was also notable that despite the rain, the water courses were generally clear at the time of the site visits and there was no sign of suspended sediment loads. The majority of the water courses in the Reserve arise as springs from the mountain slope, and as a result change abruptly from dry watersheds to flowing streams. This section details the ecological values recorded from the sampling completed in a total of six streams and three tarns. The survey locations are shown in Figure 4

### 4.2.1 Streams

#### *Stream 1*

Stream 1 is the longest surface water body present with the Reserve. It originates from several springs and seepages and forms a stream approximately 0.5 m wide (Plate 8A). The upper reach has a low gradient and the habitat include pools and riffle sand runs. At the head waters, the stream has no modification, but there is evidence of historic water use, with water abstraction infrastructure present (Plate 8B). Approximately 120 m downstream from the springs the stream is crossed by an access track and the stream is culverted (Plate 8C). The stream then descends steeply for approximately 200 m in a modified riparian zone with introduced grasses. The stream has a boulder and silt bed with no interstitial space to provide habitat for invertebrates. Silt is present in the stream which is possibly sourced from suspended sediment runoff from the above road. Spot sampling for invertebrates did not collect any aquatic invertebrates at a sample site in this reach.

The stream descends through a highly modified reach along the Easy Rider Trail, where the stream has been lined with boulders and the riparian vegetation consists of introduced grasses (Plate 8D). The stream in this section appeared to have less flow compared to the upstream reaches. It is possible that surface water is being lost to groundwater at the head of this reach.



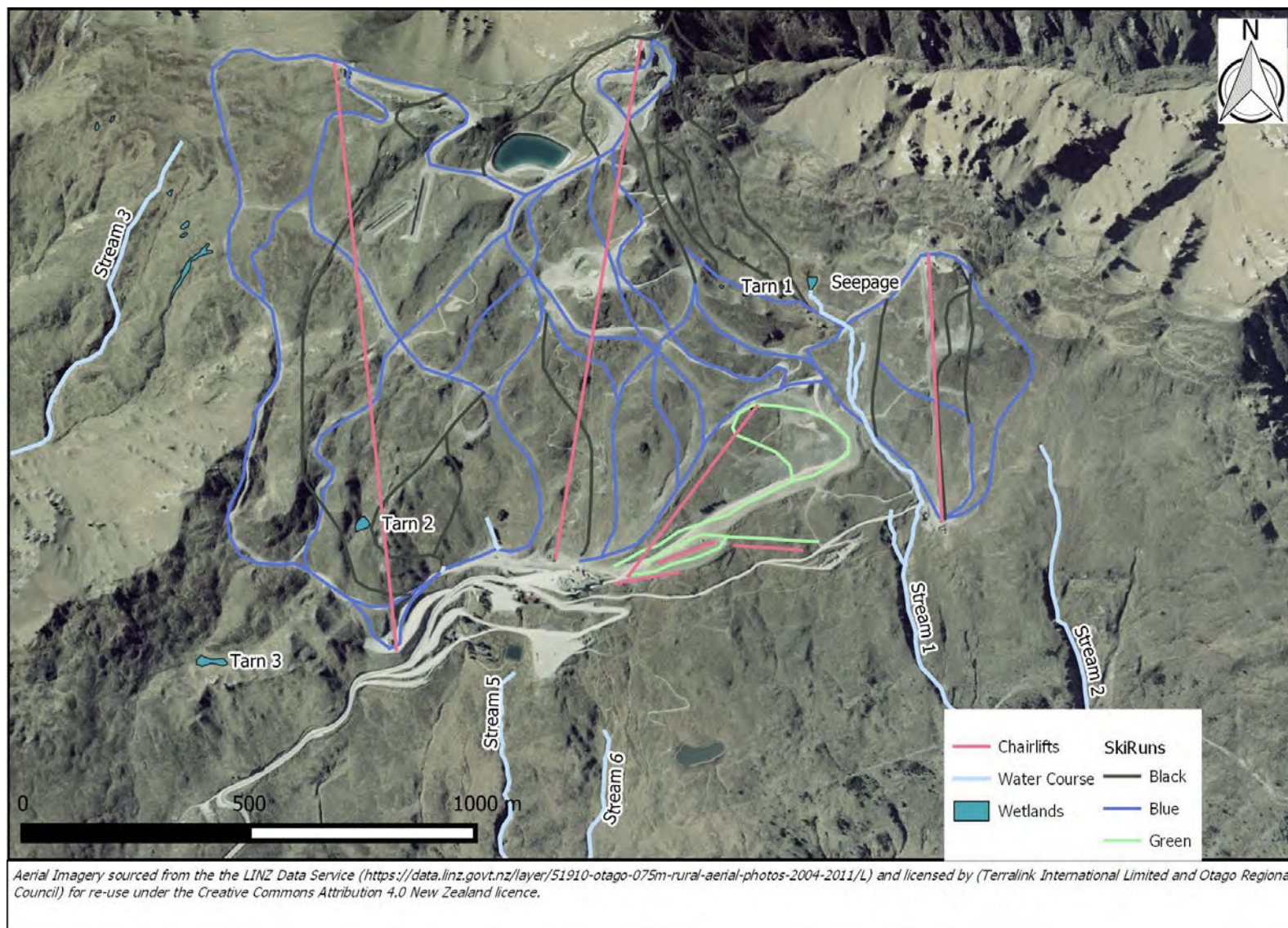


Figure 4: Location of the streams and tarns sampled during this survey.



Below the highly modified reach the stream flows under the access road to Heidi's Hut and then returns to a less modified stream course. It is joined by a second stream that arises below the access road. The streams in this section are steep with bedrock waterfalls and with native riparian vegetation (Plate 8E). The stream bed is composed of a mix of schist, sand, gravel and cobble material resting on bedrock. It is loosely packed and easily mobilised and a water intake is present (Plate 8F). Below this point the stream continues to descend steeply towards Mill Creek. Invertebrate sampling at this location included a range of insect taxa: *Deleatidium* mayflies, *Zealandoperla* stoneflies, *Scritidae* beetle larvae, two free living caddisflies; *Psilochorema* and *Castachorema* and four *Diptera* taxa; *Limonia*, *Maoridiamesa*, *Polypedium* and Tanypods.





Plate 8: Stream 1. A – Springs at the stream source. B – Disused instream infrastructure. C – Track and culvert. D – Highly modified reach of Stream 1. E – Tributaries and waterfalls downstream of the access road. F – Water intake weir.

### *Stream 2*

Stream 2 is a steeply descending straight water course. The channel included waterfalls and the habitat was dominated by riffles and cascades, with the stream bed composed of clean schist fragments. The stream was approximately 1 m wide and had a maximum depth of 0.1 m. The riparian zone is well vegetated with native shrubs and tussock (Plate 9A). This stream originates from a large spring source (Plate 9B) and is culverted under an access track. Invertebrates sampled



in Stream 2 included *Delatidium* mayflies, *Zealandobius* stoneflies, Scritidae and Elmidae beetle larve, *Costachorema* free living caddisflies and two diptera taxa, the midges *Maoridiamesa* and *Nothodixa*.

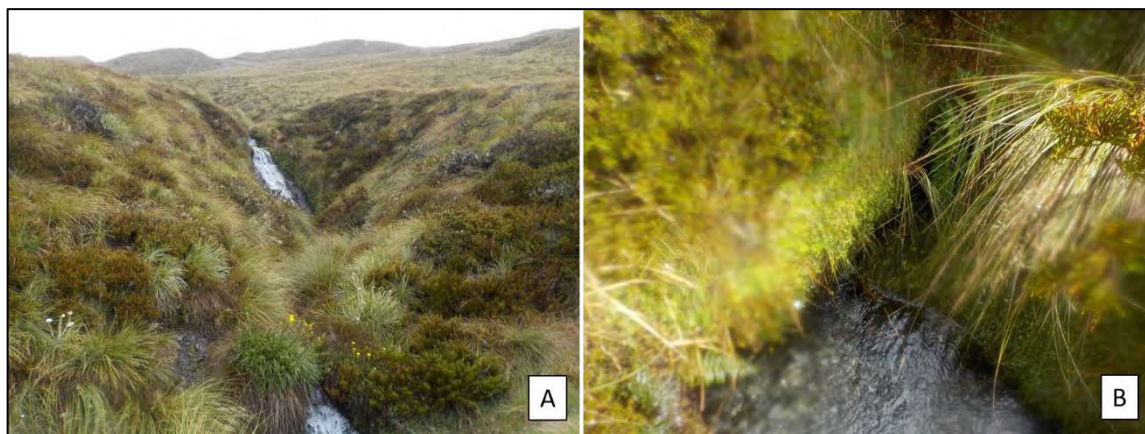


Plate 9: Stream 2. A – Waterfalls and intact riparian vegetation. B – Spring source flowing out from between mossy boulders

### Stream 3

Stream 3 is a small seepage at the head of a tributary of Dirty Four Creek, which flows into the Shotover River. Dirty Four Creek is the only stream that flows into the Shotover River catchment from the Coronet Peak Ski Field. The seepage area is a mossy wetland with a small 0.1 – 0.2 m wide stream channel with a maximum depth of 0.05 m (Plate 10A). The stream bed included a mix of well compacted soil, sand and gravel, with the riparian vegetation being mainly moss. Invertebrates sampled included *Zealandobius* stoneflies and *Maoridiamesa* midge larvae that were both common. Less frequently found were flatworms, amphipods.



Plate 10: A – Stream 3, a small seepage area at the headwater of Dirty Four Creek. B – Stream 4, upstream of the main car park area.





#### Stream 4

Stream 4 is a short spring fed stream that flows approximately 70 m from its spring source to a culvert pipe that diverts the stream under the carparking area and into a water storage pond for snow making. This stream has an average width of 0.6 m and maximum depth of 0.2 m. The stream bed consists of loose schist fragments, which provides riffle and run habitat (Plate 10B). Spot searches for invertebrates in this stream found *Deleatidium*, which was common and flatworms. No other taxa were observed.

#### Stream 5

Stream 5 originates down slope from the base building and carpark areas. This stream is steep with riffle and cascade habitat and a narrow channel less than 0.5 m wide and up to 0.2 m deep. The main riparian vegetation is native tussocks. The steep, narrow nature of the stream creates a high-water velocity habitat and the roots of riparian grass and buttercup provide no undercut banks (Plate 11A and Bbelow). Invertebrates were not encountered within the loose mobile schist bed or root wads within the stream.

#### Stream 6

Stream 6 also starts down slope from the base building and carparks, however the catchment area for this stream includes the waste water soakage field. This stream is small, and less than 0.2 m wide and less than 0.1 m deep. It is initially steep, but the gradient becomes gentler and then flows through a relatively broad valley floor (Plate 11C). The riparian margin of this stream is well vegetated with tussock, introduced grasses and the occasional hebe and willow. The small size of the stream, despite the wet weather indicates the stream may be ephemeral. Invertebrates were not encountered during the survey, although searching was limited due to habitat availability.





Plate 11: A – A steep cascade section of Stream 5. B – Stream 5, note schist fragments that were inspected for invertebrates on the riparian grasses. C – Stream 6 in the gentle sloping reach.

#### 4.2.2 Tarns

##### *Tarn 1*

Tarn 1 (Plate 12) is a small circular ephemeral tarn with no inflowing stream. On the day of the site visit, this tarn had a maximum depth of 0.1 m and it was estimated that it would reach 0.3 m deep before flowing out the outflow channel. The dominant floral components included a green algae and a turf community, however, areas of the tarn bed were bare ground. A single species of small beetle was observed swimming in the tarn. This was identified as the Dytisadae beetle species, *Antiporus* sp.





Plate 12: Tarn 1 and close up of the turf community.

### Tarn 2

Tarn 2 (Plate 13) was a large circular tarn approximately 20 – 25 m in diameter. It sits in a depression in a small water course and has both an inflow and outflowing stream, although the outflow will not flow when the tarn has a low water level. The margin of the tarn was steep sided and water depth exceeded 0.25 m throughout the tarn. This tarn had dense *Myriophyllum* beds with a gelatinous green alga abundant in the water column, as well as on the macrophyte beds. Two mollusc taxa were collected, the bivalve Sphaeriidae and the introduced great pond snail (*Lymnaea stagnalis*). No native snails were located in the tarn. *Xanthocnemis* damselflies, nymphs and *Rhantus* beetles were common and orthoclad midges larval were also present in the tarn.



Plate 13: View of tarn 2 and the outflow.



### Tarn 3

Tarn 3 is the largest tarn within the Reserve and has a figure of eight shape with two pool areas connected by a narrow section of water. This tarn is located in a small basin that has an in-inflow stream, but no outflow. The inflow stream is approximately 100 m long and originates as a spring. Additional surface inflows are likely during high rainfall events and aerial photography indicates that the tarn varies in size. The margins of the tarn are gently sloping and a turf community (Plate 14) was present around the margins to a depth of 0.5 m. In the centre of the western end of the tarn a *Myriophyllum* bed was present. This probably reflects the area of permanent or near permanent water in the tarn.

A large number of great pond snails (*Lymnaea stagnalis*) (Plate 14) (estimated density 50-100/m<sup>2</sup>), were collected during the survey, however no native snails or bivalves were located. *Rhantus* beetles were also common amongst the turf. Large numbers of copepods were collected, and a single tadpole was collected with a second seen swimming in the tarn. The tadpoles were identified as the brown tree frog (*Litoria ewingii*) (NZFrog, 2019). No damselfly nymphs were collected, but adults were present around the tarn and it is expected that the nymphs were residing in the macrophyte beds that were not sampled. The inflow stream was also sampled for invertebrates, however only oligochaetes were collected.





Plate 14: Tarn 3. A – Overview of tarn 3. B – Tarn 3 at the inflow stream. C – The shallow water turf community. D – Tadpole (preserved). E – *Lymnaea stagnalis*. F – Red copepod.

## 4.3 Fauna

### 4.3.1 Avifauna

Native species recorded during the site visits included New Zealand pipits (see Plate 15), which were widespread across the Reserve and Paradise shelducks which were observed using the snow making ponds. Other native species which



are known to use, or could use the Reserve area include the Eastern falcon, kea, and harrier hawk. Exotic species observed during the site visit included chaffinches, chukar, yellowhammer, redpoll, dunnock, greenfinch and skylark.

**Table 1: Bird species known to be found within the Reserve and their associated threat status.**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Threat Status (Robertson et al., 2017)</b>
<b>New Zealand pipit</b>	<i>Anthus novaeseelandiae</i>	At Risk - Declining
<b>Eastern falcon</b>	<i>Falco n. novaeseelandiae</i>	At Risk - Recovering
<b>Kea</b>	<i>Nestor notabilis</i>	Nationally Endangered
<b>Paradise shelduck</b>	<i>Tadorna variegata</i>	Not Threatened
<b>Harrier hawk</b>	<i>Circus approximans</i>	Not threatened
<b>Chaffinch</b>	<i>Fringilla coelebs</i>	Introduced and Naturalised
<b>Chukar</b>	<i>Alectoris chukar</i>	Introduced and Naturalised
<b>Yellowhammer</b>	<i>Emberiza citrinella</i>	Introduced and Naturalised
<b>Redpoll</b>	<i>Carduelis flammea</i>	Introduced and Naturalised
<b>Dunnock</b>	<i>Prunella modularis</i>	Introduced and Naturalised
<b>Greenfinch</b>	<i>Carduelis chloris</i>	Introduced and Naturalised
<b>Skylark</b>	<i>Alauda arvensis</i>	Introduced and Naturalised





Plate 15: New Zealand Pipit observed in the Coronet Peak Recreation Reserve.

#### 4.3.2 Lizards

Lizard species that were recorded within the Reserve area included the Not Threatened McCann's skink (*Oligosoma maccanni*) typically between 1350 m asl and Coronet Peak at approximately 1600 m asl and one At Risk – Declining southern grass skink (*Oligosoma polychroma* Clade 5) at 1384 m asl. There was little habitat for geckos as the rocks and rocky outcrops did not have enough suitable crevices and few sunny aspects, which is important at high altitudes (Knox, 2019; Hitchmough, et al., 2016).

#### 4.3.3 Invertebrates

A wide range of invertebrates have been recorded in the Conservation Resources Report for the Coronet Peak Pastoral Lease as well as the Coronet Peak Recreation Reserve, These surveys have recorded 390 species of invertebrates including 289 moth species (DOC, 2006). Species of note include the black and pink moth *Meterana meyricki* and the striped giant speargrass weevils *Lyperobius spedenii* and *L. hudsoni*, which feed on *Aciphylla kirkii* and other speargrasses.



Found on *Chionochloa* tussocks is the large weevil *Anagotis lewisi* and the upland moth *Orocrambus dicrenellus*. Fourteen high alpine moths were recorded, which inhabit rock faces, fellfield, snowbank, moss bog, flush, herbs and grasses. These species are typical of the south eastern South Island mountains, but the moth *Eudonia oreas* is endemic to Otago. Nymphs of alpine black cicada (*Maoricicada* spp.), carabid beetles including *Mecodema lucidum*, and ground weta (*Hemiandrus focalis*) can be found under rocks (DOC, 2006). The undescribed velvet worm (*Peripatus* species) is also present (DOC, 2006) (a single individual was observed along a wet creek bank during the surveys for this report). The alpine spider *Neoramia childi* has its westernmost record on Coronet Peak Station and an upland grasshopper common in snowbanks (*Alpinacris tumidicauda*) is close to its northern limit (DOC, 2006). The extensive terrain present within the Reserve will provide habitat for a wide variety of alpine invertebrates. Invertebrate pitfall trapping had been undertaken, however the results were not available at the time of writing this report.

#### 4.3.4 Introduced Animals

Hare browsing and droppings were present in all habitats throughout the Reserve, with several hares seen during the survey. Introduced pest animals such as ferrets, stoats and hedgehogs have been caught in similar habitats and altitudes on the neighbouring Brow Peak. NZ Ski have already set up a network of approximately 55 traps over the Reserve to address these introduced predators.

## 4.4 Summary of Ecological Values

A summary of the ecological values encountered during the survey and documented in previous studies are provided in Table 2 below.

**Table 2: Summary of Ecological Values.**

Ecological Value	Description
<b>Dracophyllum tussock shrubland habitat</b>	<i>Dracophyllum</i> tussock shrubland habitat is widely spread over the Reserve. Parts of this habitat has had little modification and as a result has dense native vegetation coverage, with few exotic species.





Rocky summit habitat	Rocky outcrop plant communities are present in small pockets over the Reserve, with the main area around the summit of Coronet Peak. This area has been modified, through the construction of a walkway, summit buildings and introduction of exotic plant species which are most notable in disturbed areas.
Cushion field habitat	Cushion fields are typically found on exposed ridges and spurs generally in the upper half of the Reserve. The cushion fields are typically small in area and surrounded by <i>Dracophyllum</i> tussock shrubland. Exotic species are present in the cushion fields where disturbance has occurred. Damage to cushion fields has occurred as a result of snow sport activities and mountain biking.
Presence of At Risk and Threatened flora	At Risk, Data Deficient and Threatened plants have been recorded within the Reserve. These include the At Risk – Naturally Uncommon <i>Epilobium purpuratum</i> (located on the rocky summit of Coronet Peak), Data Deficient <i>Brachyscome montana</i> , which was present in the <i>Dracophyllum</i> tussock shrubland and the Threatened – Nationally Vulnerable <i>Myosotis elderi</i> .
Freshwater habitat	The water courses in the Reserve typically arise as springs from the mountain slope, and as a result change abruptly from dry watersheds to flowing streams. The streams and tarns generally have little modification, with the modification that has occurred being culverts, water takes, and one stretch of Stream 1 is highly modified where it has been lined with boulders.  Three tarns are present within the Reserve. Two of the tarns contained the introduced great pond snails and tarn 3 had tadpoles, which were identified as the introduced brown tree frog. No threatened species were located during the site survey nor in the invertebrate samples collected.



Presence of At Risk and Threatened fauna	The Reserve provides breeding and foraging/hunting habitat for the At Risk – Declining New Zealand pipit, the At Risk – Recovering Eastern falcon and the Nationally Endangered kea.
Habitat for lizard species	Lizard species that were recorded within the Reserve area included the Not Threatened McCann's skink and one At Risk – Declining southern grass skink. There was little habitat for geckos as the rocks and rocky outcrops did not have enough suitable crevices and few sunny aspects.



## 5 Ecological Significance and Value

The assessment of the significance of the ecological values associated with the area of the Coronet Peak Recreation Reserve that the ski field operates on are based on the following:

- The Operative QLDC District Plan Criteria for assessing areas of significant indigenous vegetation (QLDC, 2009);
- The Ecological Impact Assessment (EclA) EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems, 2nd edition (EIANZ, 2018); and,
- New Zealand's Department of Conservation threatened flora and fauna lists.

### 5.1 Assessment of Ecological Value

#### 5.1.1 Vegetation Ecological Values

The 2018 EIANZ Guidelines and the Queenstown Lakes District Council District Plan set out evaluation criteria that can be used to determine the ecological values of a species or habitat. The assigned ecological value under the EIANZ Guidelines is then used along with the magnitude of the activities that have occurred within the Reserve to determine the ecological impact.

**Table 3: Assessment of the indigenous vegetative habitat using the ecological criteria in the EIANZ Guidelines and the QLDC District Plan.**

Matter	Reasoning	Score (EIANZ, 2018)	QLDC Criteria Satisfied
Representativeness	The indigenous vegetation habitats located within the Reserve area include <i>Dracophyllum</i> tussock shrubland, rocky summit habitat, cushion fields, wetlands, tarns and seepages. The assemblages of the habitats and vegetation	Very High	Yes



	<p>communities found within the Reserve have the typical structure and composition of species in the Shotover Ecological District. Areas of the Reserve which have not been disturbed are considered to contain a high level of representativeness, as indigenous species dominate.</p>		
Rarity/ distinctiveness	<p>The Reserve contains predominantly intact habitats with evidence of healthy natural ecosystem functioning such as regeneration. As a result of the elevation gradient and aspect that the Reserve covers it contains a range of different habitats and transitional sequences between species such as <i>C. macra</i> and <i>C. rigida</i>. The <i>Dracophyllum</i> tussock shrubland is common throughout the Ecological District, however the cushion fields and wetlands are less common. Alpine wetlands including tarns are listed as regionally significant under the Otago Regional Council Water Plan as they are located above 800 m.</p> <p>The vegetation and habitat supports a range of At Risk and Threatened plant and animal species. These include the At Risk – Naturally Uncommon <i>Epilobium purpuratum</i> which is located on the rocky summit of Coronet Peak; the Data Deficient <i>Brachyscome</i></p>	Very High – Moderate	Yes



	<p><i>montana</i>, which was present in the <i>Dracophyllum</i> tussock shrubland and the Threatened – Nationally Vulnerable <i>Myosotis elderi</i> which was located on the edge of the Sarah Sue trail where the exotic seed mix has been unsuccessful in establishing.</p> <p>The vegetation and habitats within the Reserve provides breeding and foraging/ hunting habitat for the At Risk – Declining New Zealand pipit, the At Risk – Recovering Eastern falcon, the Nationally Endangered kea and the At Risk – Declining southern grass skink.</p>		
Diversity and pattern	The distribution of the vegetation across the landscape reflects the natural underlying physical patterns. Species and community composition change along the altitudinal gradient, as well as being shaped by exposure to wind, sun and soil depth.	Very High	Yes
Ecological context	The habitat within the Reserve is part of a continuous tract of indigenous vegetation, with the surrounding mountains. The alpine environmental conditions, and the history of grazing, burning and disturbance for recreational activities have influenced the ecological components within the Reserve.	High	Yes



	<p>The indigenous vegetation is buffered by the surrounding landscape, however the internal disturbance and introduction of exotic weed species as a result, is causing competition for space and regeneration of native species.</p> <p>The vegetation and habitat within the Reserve also provides hunting, feeding and breeding habitat for threatened fauna species.</p>		
Size and Shape	The indigenous vegetation within the Reserve is nearly continuous and includes a range of highly representative communities that are large enough to maintain a full range of ecological functions.	N/A	Yes
Connectivity	The vegetation within the Reserve area is part of nearly continuous vegetation across the Coronet Peak Ski field, and the wider mountains including Brow Peak to the east, Mt Dewar to the west and Coronet Peak Station.	N/A	Yes
Long Term Sustainability	The habitats on site have received historic disturbance through burning and grazing, and the Reserve has since received modification associated with recreational activities for winter sports and mountain biking. As a result of this vegetation clearance, the introduction of weed species has occurred. The introduction of weeds has degraded the naturalness of the communities however the long-	N/A	Yes



	term sustainability of the indigenous systems should be preserved providing weed control programmes are maintained across the ski area.		
<b>Overall Vegetation Value (EIANZ, 2018)</b>		<b>Very High</b>	

The Coronet Peak Recreation Reserve has a range of vegetation communities, which, as a whole, satisfy all of the significance criteria under the QLDC District Plan and have an overall value under the EIANZ Guidelines of Very High.

### 5.1.2 Freshwater Ecological Values

The freshwater survey undertaken within the Reserve resulted in no threatened species or invertebrates collected. The significance of the water bodies on Coronet Peak are therefore reflected in their representativeness, intactness, rarity/distinctiveness and uniqueness.

The un-modified reaches of the streams sampled have the highest freshwater ecological values on Coronet Peak. These areas have intact, unmodified habitat and the fauna present is restricted to only native species. Although these are natural systems, there are no fish present, but this is expected due to the altitude and gradient of the streams, as well as the very limited range of native fish present in the Wakatipu Basin and surrounding mountain ranges.

The streams' invertebrate fauna did not occur in high abundance. It is likely that the stream fauna is limited by the stream gradients and possible drying events in drought summers as all the streams (except the seepage site at Stream 3), are spring fed streams. The springs are derived from aquifers on Coronet Peak and it is possible the aquifers and hence the springs dry in extreme drought periods. Mountain side streams are common and therefore none of the streams represent a rare habitat. It is also expected that mountain streams have good protection in protected land areas elsewhere in the South Island mountain ranges. Therefore, while the intact streams reaches have ecological values they are not considered to be outstanding for any particular feature.

Ranking the streams in order of ecological value would place Streams 2 and 3 as having the highest value, although these are not considered significant on a wider geographic scale. The head waters of Stream 1 and its lower reaches below



the access roads are the next most significant, due to the intact riparian zones and little if any modification in these reaches. Streams 4, 5, and 6 all have relatively low ecological value with limited or no aquatic fauna found and modified riparian zones with introduced plant species common. The highly modified reach of Stream 3 along the Easy Rider Trail has the lowest ecological values due to the highly modified nature of the stream and the lack of habitat for aquatic invertebrates.

The two large tarns (tarns 2 and 3) are significant freshwater habitats within the Reserve as tarns are uncommon. Both these water bodies appear to be permanent, although aerial imagery shows that Tarn 3 can be greatly reduced in areas during droughts. The presence of the introduced great pond snail in both tarn 2 and 3 and the presence of tadpoles in tarn 3 means that the limited aquatic fauna has been modified by the presence of these introduced species. Tadpoles of the introduced brown tree frog were observed in tarn 3, which indicates that these frogs have established in the area. It is likely that these frogs will soon colonise tarn 2 as well. Tarn 1, a small ephemeral tarn is distinct, and although it has no threatened fauna it does represent an unmodified habitat. Under the Otago Regional Council Water Plan all alpine wetlands above 800 m, which includes tarns are considered regionally significant.

### 5.1.3 Avifauna Ecological Values

The Coronet Peak Recreation Reserve provides breeding, foraging and or hunting habitat for the kea, NZ pipit and eastern falcon. These species have a conservation status of Nationally Endangered, At Risk – Declining and At Risk – Recovering, respectively. The assigned ecological value under the EIANZ (2018) guidelines for species with these conservation statuses are Very High, High and Moderate-High. However, the habitats that these species utilise within the Reserve are wide spread. Under the EIANZ guidelines all other native bird species that are classified as Not Threatened have a low ecological value.

### 5.1.4 Lizard Ecological Values

The abundance of lizard species within the Reserve area was low, and only two species were located during the survey. These species are the Not Threatened **McCann's skink** and the At Risk – Declining southern grass skink. The assigned ecological value under the EIANZ (2018) guidelines for species with these





conservation statuses are Low and High, respectively. The habitats that these species use within the Reserve are wide spread. No geckos were located during the survey and the rocks and rocky outcrops within the Reserve did not have enough suitable crevices

## 5.2 Summary of Ecological Significance Values

The ecological values of the vegetation habitats and fauna found within the Coronet Peak Recreation Reserve range from Low to Very High. The overall ecological value of the vegetation communities is Very High, which reflects the range of habitats present, as well as the undisturbed nature of large areas of the Reserve. The overall ecological value of the freshwater habitat is Low, as they do not support any threatened species, but provide habitat for native species. The ecological value of the avifauna ranges from Very High to Moderate-High and the ecological value of the At Risk – Declining southern grass skink is High.



## 6 Ecological Impact Assessment

### 6.1 Ecological Impact Assessment

The ecological impact assessment follows the 2018 EIANZ Ecological Impact Assessment Guidelines for New Zealand. These guidelines are based on the assessment of the ecological values present within the Reserve (see Section 5) and the magnitude of the effect of the activity, which is then used to determine the ecological impact. Both direct and indirect ecological impacts have occurred as a result of the ski field operation as set out below.

### 6.2 Direct Impacts

The main impact that has occurred within the Coronet Peak Recreation Reserve is the removal of indigenous vegetation to support the construction of ski trails. The vegetation disturbance along the ski trails is permanent, particularly where an exotic seed mix has been sown onto the cleared ground. The magnitude of the effect of the disturbance to the vegetation is High as the disturbance is on a permanent basis, and generally threatened plant species are removed. The ecological effect on the vegetation (without mitigation) is therefore assessed as being Very High (a Very High ecological value and a High magnitude of effect). However, NZ Ski have a tested methodology that enables them to relocate the indigenous vegetation, in particular tussock and associated small under growth species, which lowers the ecological impact.

The removal of the vegetation and disturbance of rocky habitat has resulted in permanent habitat loss for threatened and at-risk native bird and lizard species that utilise the alpine environment. At present, there is still abundant habitat that these species can use within the Coronet Peak Recreation Reserve as well as in the wider area. Therefore, the removal of the habitat is considered to have a Low magnitude of effect as there has only been a minor shift away from the base line conditions when considering the extent of available habitat. The overall ecological impact of the vegetation and habitat removal on these threatened species has been considered to be Moderate to Low.

The sowing of the exotic alpine seed mix on the ski trails has resulted in competition between native and exotic species. The exotic species, especially in the lower



elevations of the ski area have formed a thick cover, which has prevented native species from colonising the disturbed ground. The use of the exotic seed mix results in a major alteration to the existing baseline conditions of the areas such that the composition of the species that are colonising the area is fundamentally changed. The magnitude of these effects is considered to be High. The ecological impact of replacing native vegetation with exotic grass is considered to be Very High. At higher elevations, where the seed mix is not successful in striking on the trails, and bare areas remain, native vegetation seedlings were noted.

A direct impact of the snow sport activities that has occurred is damage to areas of cushion fields. Cushion fields are located on exposed ridges, where the snow accumulation can be thin. As a result, as snow users move between gullies, or snow is ploughed, cushion fields can be disturbed, and vegetation damaged. The scale of the disturbance encountered is relatively low and the magnitude of the effect is accordingly low, however damage to vegetation which has Very High ecological value is a Moderate ecological impact.

The direct freshwater impacts are predominantly habitat modification. This is most apparent in Stream 1 with the complete modification of the mid-reach of this stream has occurred along the Big Easy Trail. Other modifications of streams include the construction of water intake structures for water supplies, culverting and piping of streams under carparks. Piping and culverting have resulted in the natural habitat being replaced by concrete pipes, which, if fish were present would have created fish passage issues. The collection of water from the streams for snow making also alters stream flows and may impact the abundance of aquatic organisms that can be supported by these streams. Although various freshwater habitat modifications have occurred, they have occurred on a relatively small scale, therefore the magnitude of the effect is Moderate, as there is only a partial change to the existing conditions. The ecological impact on the freshwater habitats is therefore considered to be Low. It is noted the water abstractions are activities consented by the Otago Regional Council.

### 6.3 Indirect Impacts

An indirect effect of the construction of the roading and trails is the mobilisation of sediment into the native vegetation and streams. This impact occurs mostly during the snow melt and periods of high rainfall. Areas of indigenous vegetation are being smothered by sediments that are mobilised, in particular from access



roads, where the sediments are caught by the native vegetation. These areas create patches of 'bare' ground in amongst the native vegetation and predominantly colonised by the exotic species. The ecological impact of the sedimentation is Very High as there is a High magnitude of effect, as there is a fundamental change to the ecology and habitats with Very High value. This indirect effect can be managed by improving the drainage and diversion of water.

Another indirect effect that has occurred within the Reserve is the spread of exotic weed species throughout the indigenous vegetation. All indigenous habitats contained exotic weed species, however as distance increases from a trail, the level of exotic vegetation decreased. This spread of the exotic weed species, are the result of sowing of the trails. The further introduction and spread of exotic weed species within the Reserve will result in competition for space and resources, resulting in a fundamental change in the ecology of the vegetation. The ecological impact of this, without management measures is Very High (a Very High ecological value and a High magnitude of effect).

## 6.4 Summary of Ecological Effects

Ideally ecological impacts are avoided, however given the proximity of the vegetation and streams to current ski field activities, this is unlikely. The direct impacts that have occurred within the Reserve are vegetation clearance, habitat loss for threatened and at-risk native bird and lizard species, sowing of the exotic seeds on the ski trails resulting in competition between native and exotic species, damage to areas of cushion fields and habitat modification of freshwater systems. The indirect effects that have occurred as a result of the construction of the roading and trails is the mobilisation of sediment into the streams and onto native vegetation where it is being smothered in some isolated areas, and the spread of exotic weed species through the indigenous vegetation.



## 7 Recommendations to Manage Ongoing Activities

The ecological impact assessment for the area of the Coronet Peak Recreation Reserve that the ski field operates on has highlighted a range of impacts that have occurred. Management of these impacts is recommended as follows. We note that NZ Ski have already implemented several measures to manage the effects of the recreational activities and improve the ecology.

### 7.1 Recommendations

#### 7.1.1 Sediment Runoff

To reduce the sediment runoff from the roads and trails into the native vegetation and streams, it is recommended that NZ Ski improve the surface of the formed roads, as well as improving and adding drainage and diversion channels, and structures to reduce surface runoff velocity. A combination of these measures may be required across the Reserve in order to reduce soil erosion and sediment mobilisation.

#### 7.1.2 Exotic Alpine Seed Mix

The exotic alpine seed mix that is sown on the ski trails is an ongoing source of weed species that are invading the indigenous vegetation communities within the Reserve. However, it is recognised that the seed mix performs an important role in ground stabilisation. It is recommended that the Department of Conservation and NZ Ski review the use of this mix, the density at which it is applied and the species composition. It is suggested that the revised alpine seed mix incorporate native species which colonise disturbed ground.

#### 7.1.3 Weed Control

NZ Ski currently spray and control a range of woody weeds such as grey willow, wilding conifer trees, briar, broom, and gorse across the ski area. It is recommended that this control be extended to all weed species not included in the alpine seed mix surrounding the base buildings, upper and lower lift terminals, and along the edges of the main trails. It is also proposed that NZ Ski control any



future woody weeds and wilding species that invade the area where NZ Ski is licensed to operate or has easements.

Clarification on the management of weed control around the club huts is required.

#### 7.1.4 Pest Management

Pest management of ferrets, stoats, rats, hedgehogs, hares and possums is recommended in the Reserve to reduce predation on the Threatened and At-Risk plant, bird, lizard and invertebrate species which are found in and use this area. NZ Ski have already initiated a pest control programme and have recently placed 55 traps around the ski field that will target ferrets, stoats, rats and hedgehogs. It is proposed that NZ Ski add possum traps to their trapping network.

Hare grazing of indigenous vegetation is significant across the Reserve. It is recommended that NZ Ski actively control these pests within the ski area through methods such as shooting on an ongoing basis.

#### 7.1.5 Freshwater

There are structures in the streams where historic and present water supply takes have been installed. It is recommended that any unused structures are removed from the streams to improve their natural state and further modifications to the stream courses should be avoided.

#### 7.1.6 Rubbish

Throughout the vegetation communities and streams there is a collection of rubbish material. It is proposed that all rubbish material is removed from within the streams, and rubbish collection occurs over the whole of the license area and not just on the main ski trails. As the ski field covers a large area, collection of the rubbish could be staged to allow thorough coverage of all habitats.

#### 7.1.7 Plantings

Throughout the ski field are areas where earthworks have occurred, but revegetation has either not occurred or has been unsuccessful. It is proposed that NZ Ski identify all areas which are not used for ski activities and overtime replant these areas, particularly cut faces and batters, with native tussocks that have



been eco-sourced from within the Reserve. It is understood that NZ Ski already have a process where seed is collected from the tussocks and are grown on to be used for restoration plantings. Stabilising the exposed areas with vegetation will help to reduce soil erosion and sedimentation.

#### 7.1.8 Grooming

The cushion fields within the Reserve have shown damage as a result of the snow sport activities as well as from mechanical equipment. Damage to cushion field vegetation by snow users is unable to be managed, however snow plough movements can be managed. Cushion field in locations such as around the Ice Bar seat show track damage. It is recommended that NZ Ski review their grooming procedures over cushion fields in order to prevent further damage to these environments.

#### 7.1.9 Lizard Management

Lizards are present in low abundance within the Reserve. To minimise any future impacts, disturbed areas are to be revegetated with native vegetation and any habitat rehabilitated.

### 7.2 Monitoring

A monitoring program should be established to determine the ongoing effects of the ski field activities on the cushion fields and the spread of weeds throughout the native vegetation.

The monitoring program for the cushion fields is to be used to determine the condition of the cushion fields, in particular the areas around the Exchange Drop and Back Bowl Trails, and whether these communities are deteriorating further over time. The monitoring of the health of these communities will be used to determine the required actions going forward.

Monitoring of the spread of weeds into the indigenous vegetation within the Reserve is also required. The monitoring of the rate and species composition of weed spread, in particular to sensitive areas such as the wetlands is to be established. This information is to be used to determine future weed control methods.



## 8 Future Proposal

### 8.1 SnowFactory Overview

NZ Ski have concept plans for the installation of a SnowFactory, which will increase the capacity of the lower mountain snowmaking system in winter and would also enable snow production out of season. Snow can be pumped through an overground pipe from the SnowFactory for a range of 300 m. In the summer the snow would be deposited on the magic carpet learners slope (see Figure 5), where it would be spread using a groomer. NZ Ski propose to make snow for four months over the summer period. The SnowFactory SF210 requires no chemical additives, therefore the only requirements for this system to make snow are power and potable water. All runoff from the snow melt would be directed into the stormwater system.

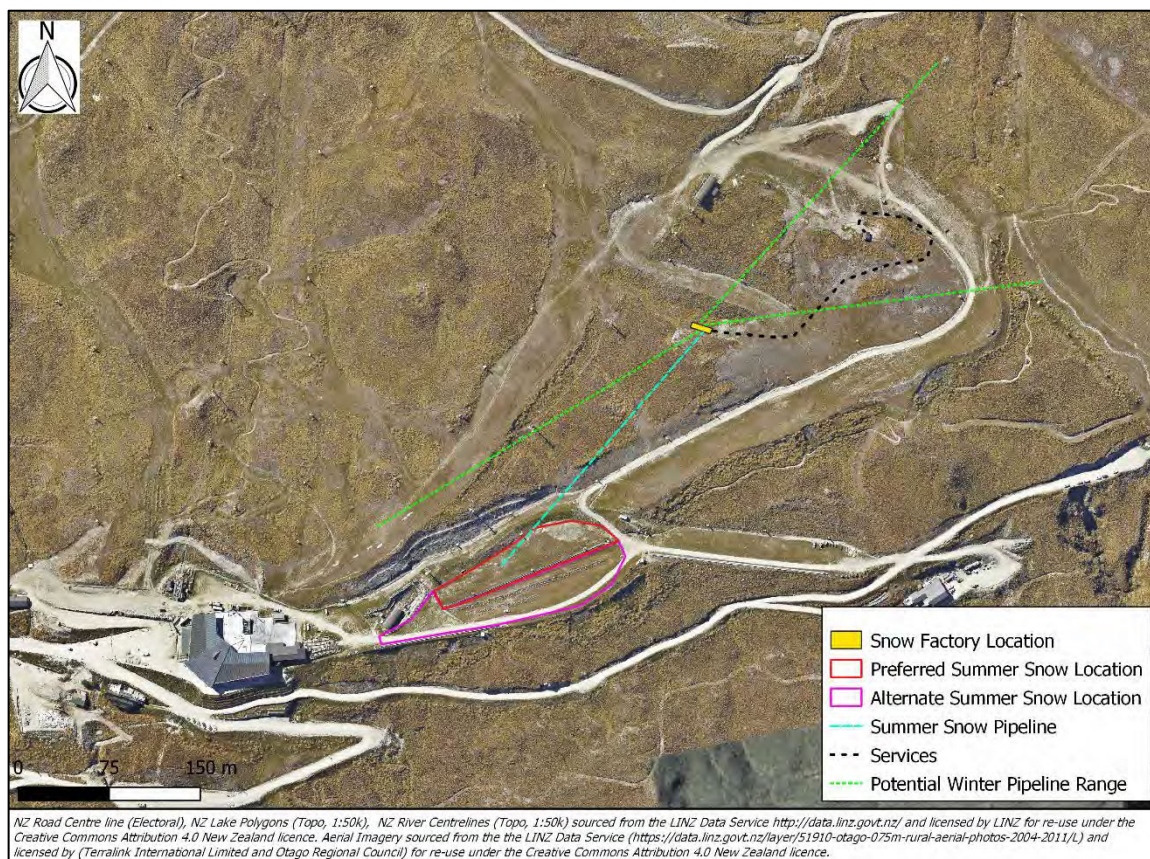


Figure 5: Proposed SnowFactory location and snow deposit area.

The SnowFactory would consist of two stacked 12.2 m long by 3.6 m wide shipping containers, sitting on an equivalent sized concrete base. Power and potable





water would be trenched to the container from PS400 (see Figure 5). The snow would be piped around the mountain through a 110 - 150 mm diameter pipe, which will lie on the ground.

## 8.2 Ecological Values

### 8.2.1 Vegetation

The vegetation present within the services route and the preferred and alternate summer snow locations is exotic grasses, weed species (see Plate 16), with a few scattered regenerating native species. The dominant species present include brown top, white clover and fine fescue. A range of other exotic species are present including yarrow, red clover, stinking mayweed, sheeps sorrel, chickweed, mouse ear hawkweed, cocksfoot, sweet vernal and timothy-grass. Native species include *Wahlenbergia albomarginata*, *Raoulia subsericea*, *Geranium brevicaula*, *Anaphalioides bellidioides*, *Epilobium pernitens* and *Gaultheria depressa* var. *novae-zealandiae* as well as small seedlings of *Ozothamnus vauvilliersii* and *Dracophyllum rosmarinifolium*.



Plate 16: Photographs showing the vegetation present in the preferred summer snow location (A and B) and the services route (C and D).



The location of the proposed SnowFactory containers is predominantly on existing disturbed ground and exotic grasses and weeds (see Plate 17). However, upslope of the proposed location, *Dracophyllum* tussock shrubland vegetation is present (see Section 4.1 for a description of this vegetation). The area of native vegetation that would be relocated for the SnowFactory has already been disturbed.



Plate 17: Photographs showing the proposed location of the SnowFactory and surrounding vegetation.

### 8.2.2 Fauna

As described in Section 4.3, the Coronet Peak Recreation Reserve provides habitat for At-Risk and Threatened bird species and At-Risk lizard species, however the abundance of lizards present within the Reserve is low. The At Risk – Declining NZ Pipit was heard nearby to the proposed summer snow location.

A hare was observed in the grass of the preferred summer snow location. Hare poo was present over most of the area and the grass had been grazed.



## 8.3 Assessment of Ecological Significance and Value

The assessment of the significance of the ecological values associated with the SnowFactory is based on the following:

- The Operative QLDC District Plan Criteria for assessing areas of significant indigenous vegetation (QLDC, 2009);
- The Ecological Impact Assessment (EclA) EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems, 2nd edition (EIANZ, 2018); and,
- New Zealand's Department of Conservation threatened flora and fauna lists.

### 8.3.1 Vegetation Ecological Values

The vegetation ecological values of the areas associated with the SnowFactory area as shown in Figure 5 has been assessed using the 2018 EIANZ Guidelines and the Queenstown Lakes District Council District Plan evaluation criteria.

**Table 4: Assessment of the indigenous vegetative habitat associated with the SnowFactory using the ecological criteria in the EIANZ Guidelines and the QLDC District Plan.**

Matter	Reasoning	Score (EIANZ, 2018)	QLDC Criteria Satisfied
Representativeness	The <i>Dracophyllum</i> tussock shrubland that is present upslope of the proposed SnowFactory contains the typical species that are found within this vegetation community across the Coronet Peak Recreation Reserve. However, this area of indigenous vegetation has historically been disturbed. The indigenous vegetation is considered to be representative due to the species present. The moderate/high	Moderate - High	No



	score reflects the historical disturbance of this vegetation.		
Rarity/ distinctiveness	The historically disturbed indigenous vegetation located above the SnowFactory has a species composition that is widespread through the Reserve and Ecological District. This vegetation forms part of the wider network within the Reserve that provides breeding, hunting and foraging habitat for the At Risk – Declining New Zealand pipit, At Risk – Recovering Eastern falcon, Nationally Endangered kea, and the At Risk – Declining southern grass skink.	Moderate	Yes
Diversity and pattern	The diversity of the indigenous vegetation present within this area is typical of this habitat, however due to the historic disturbance that has occurred, exotic species are present.	Moderate	Yes
Ecological context	The area of vegetation that is required to be cleared for the installation of the SnowFactory containers is very small, however, the vegetation forms part of the wider community which provides habitat for fauna within the Reserve. However, the past disturbance has influenced the vegetation, which has resulted in the introduction of exotic weed species.	High	Yes
Size and Shape	The indigenous vegetation within the Reserve is nearly continuous and includes a range of highly	N/A	Yes



	representative communities that are large enough to maintain a full range of ecological functions, however the area of indigenous vegetation to be removed for the SnowFactory would be very small.		
Connectivity	The vegetation within the Reserve area is part of nearly continuous vegetation across the Coronet Peak Ski field, and the wider mountains including Brow Peak to the east, Mt Dewar to the west and Coronet Peak Station.	N/A	Yes
Long Term Sustainability	The vegetation associated with the SnowFactory has undergone past disturbance and weed species are present. The introduction of weeds has degraded the naturalness of the vegetation, however, the long-term sustainability of the vegetation will be maintained as long as the weed control program is undertaken across the ski area.	N/A	Yes
<b>Overall Vegetation Value (EIANZ, 2018)</b>		<b>Moderate</b>	

The *Dracophyllum* tussock shrubland that is proposed to be removed for the installation of the SnowFactory satisfies most of the significance criteria under the QLDC District Plan and has an overall value under the EIANZ Guidelines of Moderate.

### 8.3.2 Avifauna Ecological Values

As discussed in Section 5.1.3, the Coronet Peak Recreation Reserve provides breeding, foraging and or hunting habitat for the kea, NZ pipit and eastern falcon. The *Dracophyllum* tussock shrubland that would be removed for the installation of the SnowFactory is small and this habitat is widely spread within the Reserve.



### 8.3.3 Lizard Ecological Values

The abundance of lizard species within the Reserve area is low, and only two species (the Not Threatened McCann's skink and the At Risk – Declining southern grass skink) were located during the survey of the ski field (as discussed in Section 5.1.4). The *Dracophyllum* tussock shrubland is habitat that these species could utilise, however this habitat is wide spread.

### 8.3.4 Summary of Ecological Significance Values

The ecological values of the *Dracophyllum* tussock shrubland, habitats and fauna that could use the area range from Low to Very High. The overall ecological value of the vegetation communities is Moderate, which reflects the previous disturbance that has occurred. The ecological value of the avifauna ranges from Very High to Moderate-High and the ecological value of the At Risk – Declining southern grass skink is High.

## 8.4 Ecological Impact Assessment - SnowFactory

The ecological impact assessment for the SnowFactory follows the 2018 EIANZ Ecological Impact Assessment Guidelines for New Zealand. This assessment is based on the ecological values identified in Section 8.3 above. The potential indirect and direct ecological impacts that could occur as a result of the SnowFactory are set out below.

### 8.4.1 Direct Impacts

The removal of indigenous vegetation for the installation of the containers for the SnowFactory will result in loss of native vegetation and habitat. The magnitude of the proposed effect of the disturbance to the vegetation is High as the disturbance is on a permanent basis. The ecological effect on the vegetation (without mitigation) is therefore assessed as being Moderate (a Moderate ecological value and a High magnitude of effect). However, NZ Ski propose to relocate the vegetation to a berm that will be created on the exotic vegetation in front of the SnowFactory containers. NZ Ski have a tested methodology that enables them to relocate the indigenous vegetation, in particular tussock and associated small under growth species, which reduces the potential ecological impact.



Another direct effect of making snow over the summer months is the runoff and mobilisation of sediment that will result from the melting of the snow. The sediment runoff has the potential to impact indigenous vegetation downslope from the magic carpet, and also enter waterways. The effect from this potential impact is considered to be Moderate – High. NZ Ski propose to manage the runoff by diverting all water into their existing stormwater drains. This will minimise any potential effects that could arise.

The creation of a snow slope during the off season period, will result in additional people and noise being present within the alpine environment. The magic carpet and surrounding areas provide habitat for foraging, breeding and hunting of bird and lizard species. The snow slope will result in the loss of habitat that bird and lizard species will use due to the disturbance created by the presence of people. However, the removal of the habitat is considered to have a Low effect when considering the extent of available habitat that these species can use.

#### 8.4.2 Indirect Impacts

An indirect effect that may occur within the area where the SnowFactory containers are proposed to go is the further spreading of exotic weed species throughout the indigenous vegetation. The ecological impact of this, without management measures is Moderate (a Moderate ecological value and a High magnitude of effect). NZ Ski propose to relocate all indigenous vegetation, which will help to minimise exposed ground that exotic species can colonise.

### 8.5 Recommendations

To lessen the ecological impact of the vegetation clearance within the location of the SnowFactory area, e3s recommends the following conditions.

1. All native vegetation that is proposed to be disturbed for the installation of the SnowFactory containers is to be relocated in one movement. No vegetation is to be stored on site.
2. No indigenous vegetation that has not already been historically disturbed is to be removed.
3. Planting of native plant species propagated from seed collected from the surrounding landscape is to occur on any areas that do not have native vegetation re-instated on them within 12 months of the works occurring.



4. All runoff and melt water from the snow is to be directed into NZ Ski's stormwater system.

## 8.6 Summary

The proposed SnowFactory will consist of two stacked containers sitting on an equivalent sized concrete base, with power and potable water trenched to the container from PS400. The services trench, the location of the summer snow and the majority of the SnowFactory is proposed on exotic vegetation with scattered regenerating natives. A small area of indigenous *Dracophyllum* tussock shrubland will be removed for the installation of the two containers, however this vegetation has historically been disturbed. Relocation of all existing indigenous vegetation, planting of any unvegetated areas, and, water and sediment runoff control is proposed.





## 9 Conclusions

Based on the ecological assessment the following conclusions are made:

1. NZ Ski is currently seeking a lease agreement with the Department of Conservation for the use of the Coronet Peak Recreation Reserve.
2. The Coronet Peak Recreation Reserve is an alpine reserve situated predominantly over the southern face of Coronet Peak and is located within the Shotover Ecological District of the Lakes Ecological Region.
3. The Reserve consists predominantly of *Dracophyllum* – tussock shrubland, however other vegetation communities such as cushion fields, wetlands, seepages, rocky outcrops and exotic grasslands are present.
4. As a whole, the vegetation communities and plant species within the area of the Coronet Peak Recreation Reserve that the ski field operates on, satisfy all the significance criteria under the QLDC District Plan and have an overall value under the EIANZ Guidelines of Very High
5. The Reserve contains several watercourses which typically arise as springs from the mountain slope, and as a result change abruptly from dry watersheds to flowing streams. Three tarns are also present within the Reserve boundary.
6. The freshwater survey undertaken within the Reserve resulted in no threatened species or invertebrates collected. The overall ecological value of the freshwater habitat is Low, although the tarns are considered to be regionally significant under the ORC Water Plan.
7. The Coronet Peak Recreation Reserve provides breeding, foraging and or hunting habitat for At Risk and Threatened fauna species. These include the kea, NZ pipit, eastern falcon and southern grass skink. The ecological value of the At Risk and Threatened fauna ranges from Very High to Moderate-High.
8. The Reserve has been both directly and indirectly affected by the recreational activities that have and are occurring. The Reserve has undergone modification to operate as a ski field and now contains a range of buildings, snow making ponds, lifts, roads, ski trails and other associated structures.
9. The impacts that have occurred within the Reserve are vegetation clearance, habitat loss, introduction of exotic species, damage to areas of



cushion fields, habitat modification of freshwater systems and sediment runoff into the streams and onto native vegetation.

10. Recommendations are provided in Section 7 of this report to minimise the impacts. However, NZ Ski have already implemented measures to manage some of the effects of the recreational activities and improve the ecology of the Reserve.
11. Monitoring is proposed to further understand the impacts that are occurring on the cushion fields and determine the spread of exotic species within the Reserve.
12. The recommendations from the ecological assessment for the proposed SnowFactory are to be implemented to minimise any potential effects.



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Department of Conservation  
*Te Papa Atawhai*

Ref: 100689-OTH

18 April 2023

Nigel Kerr  
Ski Area Manager, Coronet Peak  
NZSki Limited

By email to: [REDACTED]

Tēnā koe Nigel

**CONCESSION APPLICATION: 100689-OTH: REQUEST FOR FURTHER INFORMATION**

The Department is currently assessing your concession application received on 9 July 2022 for a proposal to construct mountain bike trails as part of your mountain bike development plans within Coronet Peak Recreation Reserve.

It has been determined that further information is necessary pursuant to section 17SD of the Conservation Act 1987, considered necessary to enable a decision to be made.

The information you need to supply is listed below:

1. Clarity on the ecological effects of the individual elements of works proposed. The ecological assessment included in your application is dated January 2019 and was an assessment prepared for the Coronet Peak Lease. The Department requires an environmental impact assessment specific to this mountain bike trail development proposal, for example, volumes of cut and fill and mitigation measures. This further information should include, but is not limited to:
  - (a) ecological values;
  - (b) herpetofauna (lizard) assessment;
  - (c) archaeological and heritage values;
  - (d) geological, landform and landscape values;
  - (e) risks and natural hazards; and
  - (f) recreation values (including impact on other users of the reserve).
2. Shapefiles. Please provide shapefiles of the mountain bike trails in accordance with the five plans included in your application labelled “*Southern Land Development Consultants – Coronet Peak Mountain Bike Trails: Existing & Proposed – Masterplan (5 of 5)*”.

**Department of Conservation** *Te Papa Atawhai*

Ōtepoti Dunedin Office | Level 1, John Wickliffe House, 265 Princes St, Dunedin 9016 | P O Box 5244, Dunedin 9054 [www.doc.govt.nz](http://www.doc.govt.nz)

3. Structures. Please clarify if the structures included in your application are to remain in-situ permanently.

This information is required to enable the Department to start assessing the application in more detail and to understand the full scope of works and mitigation measures involved in this mountain bike trail plan.

The Department would also like to bring to your attention any consents that may be required from regional and local authorities in relation to this project, as any information you may have collated to date, say for any RMA consents, may assist you in answering the further information requested above.

If you require any clarification on the information requested then, in the first instance, contact Kate Hamilton, Ranger Community, at email [REDACTED]

All requested information must be provided by 31 May 2023, or sooner if practicable.

Please provide the requested information to Kelvin Brown, Permissions Advisor, at email [REDACTED] and if you require additional time to provide this information, please contact Kelvin Brown immediately.

Please contact Kelvin Brown (at email [REDACTED]) if you have any questions about the on-going concession application process.

Nāku noa, nā,

[REDACTED]

Kohatu Leach-Wahanui  
Permissions Regulatory Delivery Manager (Acting)  
National Operations and Regulatory Services  
Department of Conservation | Te Papa Atawhai  
[www.doc.govt.nz](http://www.doc.govt.nz)

**From:** [Nigel Kerr](#)  
**To:** [Kelvin Brown](#)  
**Cc:** [Kate Hamilton](#)  
**Subject:** RE: 100689-OTH - NZSki Limited - Coronet Peak mountain bike trail plan - Request for further information  
**Date:** Monday, 24 April 2023 9:25:46 am  
**Attachments:** W3100\_M8a\_MTB\_Track\_Masterplan 22.04.23.zip

---

This time

**Nigel Kerr**

Ski Area Manager | Coronet Peak | Ph: + [REDACTED]

---

**From:** Nigel Kerr [REDACTED]  
**Sent:** Monday, April 24, 2023 9:23 AM  
**To:** Kelvin Brown [REDACTED]  
**Cc:** Kate Hamilton [REDACTED]  
**Subject:** RE: 100689-OTH - NZSki Limited - Coronet Peak mountain bike trail plan - Request for further information

Kia ora Kelvin

Thank you. Good to hear something is happening.

So I have engaged E3 to do an ecological assessment and the plan is to get the onsite inspections asap before the onset of winter. If we are successful there we expect the assessment to be with you by the end of May.

The shape files of the additional proposed trails in the Masterplan application are attached. Please note the existing three and the proposed Wakatipu view have already been supplied. Structures. At this stage the plan is to remove all large structures annually. The exception to this would be low small bridges on watercourses that are no higher than 30cm above ground level. Its better to leave those in situ.

Term. You mentioned confusion over the term applied for. Given the history of Mountain biking in this area it is fair to state that they are expected to have a life time of more than ten years. The wording in our application came from RMA thinking. Where you have a limited time to actually construct what you are applying for.

In this situation we are applying for a 30 year term for the construction and use of the Mountain Bike trails shown.

If there are any other questions let me know. Otherwise snow on the ground this morning.

Kind regards

**Nigel Kerr**

Ski Area Manager | Coronet Peak | Ph: + [REDACTED]

---

**From:** Kelvin Brown [REDACTED]  
**Sent:** Tuesday, April 18, 2023 10:07 AM  
**To:** Nigel Kerr [REDACTED]  
**Subject:** 100689-OTH - NZSki Limited - Coronet Peak mountain bike trail plan - Request for further information

Kia ora Nigel

Please find attached a letter dated 18 April 2023 requesting further information on the Coronet Peak ski area mountain bike trail plan.

Ngā mihi,

Kelvin Brown

Permissions Advisor

**Kelvin Brown** | Permissions Advisor

**Department of Conservation** | *Te Papa Atawhai* | Dunedin Service Centre |

PO Box 5244, Dunedin 9054 | Level 1, John Wickliffe House, 265 Princes Street, Dunedin 9016 | New Zealand

Office Ph: 03 477 0677 | Mobile: [REDACTED] | Email: [REDACTED] | Web: [www.doc.govt.nz](http://www.doc.govt.nz)  
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Coronet Peak  
Mountain Bike  
Tracks  
Ecological Impact  
Assessment

NZ Ski Limited

*June 2023*



Arrow Lane Arrowtown 9302

[www.e3scientific.co.nz](http://www.e3scientific.co.nz)

## Ecological Impact Assessment

### Document Status

Version	Purpose of Document	Prepared By	Reviewer	Review Date
A	Draft for internal review	TA/LSW	GD	9 June 2023
C	Draft for client review	LSW	GD	12 June 2023
D	FINAL	LSW	GD	12 June 2023



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# 1 Introduction

## 1.1 Overview

NZ Ski Limited (NZ Ski) is proposing extending the network of mountain bike trails within the Department of Conservation (DOC) managed, Coronet Peak Recreation Reserve (CPRR). Vegetation clearance and earthworks are proposed to establish the trails. As such, resource consent from Queenstown Lakes District Council (QLDC) and permission from the Department of Conservation is required. NZ Ski commissioned e3Scientific Limited (e3s) to undertake an Ecological Impact Assessment (EclA) of the proposed trails to assess the potential ecological impacts of the proposal.

## 1.2 Description of the Activity

The Coronet Peak Recreation Reserve is an alpine reserve situated predominantly over the southern face of Coronet Peak and contains the Coronet Peak Ski Field, which is operated by NZ Ski. The CPRR is detailed in Figure 1 and is henceforth referred to as the 'study area' (see Figure 1).

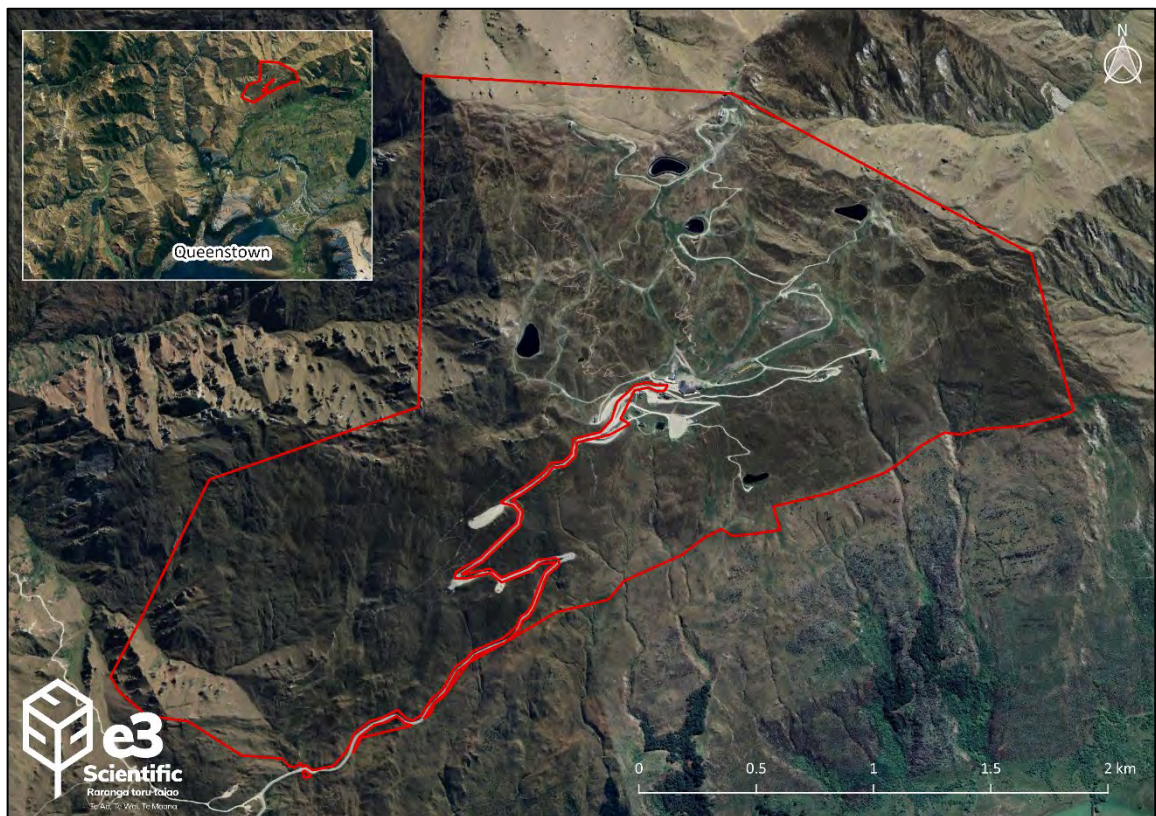


Figure 1: Site location.

There are currently four consented trails covering approximately 8,348 m in length within the CPRR. NZ Ski propose to construct an additional 11,154 linear metres of mountain bike trails, as detailed in Figure 2. The proposed trails will be constructed in accordance with the New Zealand Mountain Bike Trail Design & Construction Guidelines (Carter *et al.* 2018). It is therefore expected that the trail widths will be between 0.8 and 1.8 metres in width depending on the grade and slope (see Table 1). The area of disturbance has been calculated based upon the predicted widths ranges and assuming an average slope of approximately 30 degrees. However, this may be reduced in areas with less steep terrain, or with higher grade trails. Typically, disturbance at corners or steep areas is wider than straight sections of trail.

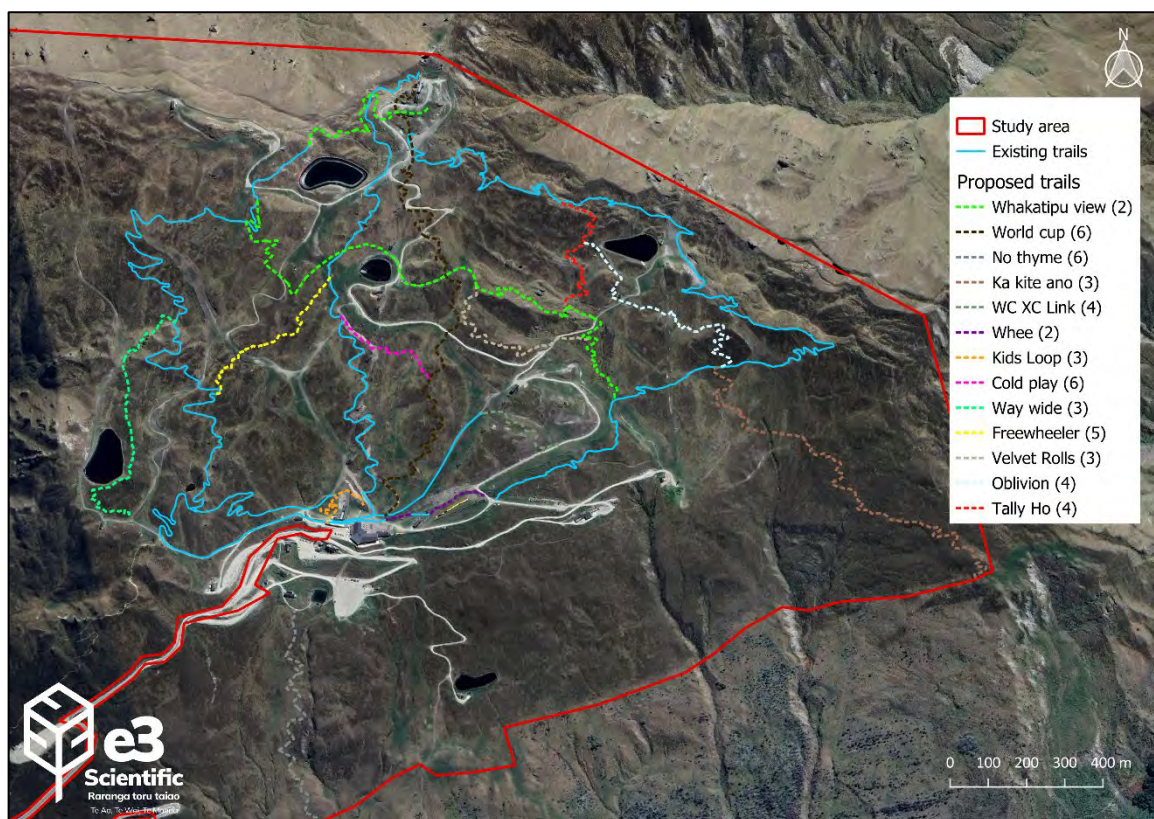


Figure 2: Proposed trail alignment.

Table 1: Proposed disturbance areas.

Name	Grade	Width (m)	Length (m)	Minimum disturbance (m <sup>2</sup> )	Maximum disturbance (m <sup>2</sup> )
Whakatipu view	Grade 2	0.8-1.2	2394	2,072	2968
Whee			229	198	284
Ka kite ano	Grade 3	0.8-1.4	1,377	1,192	1,981
Kids loop			282	244	406
Way wide			868	751	1,249
Velvet rolls			596	516	857
WC XC link	Grade 4	0.8-1.6	268	232	438
Oblivion			833	721	1,361
Tally ho			544	471	889
Freewheeler	Grade 5	0.8-1.8	537	465	983
World cup	Grade 6	1-1.8	1,823	1914	3,336
No thyme			853	896	1,561
Cold play			329	345	602
<b>Total</b>			<b>10933</b>	<b>10,016</b>	<b>16,914</b>

It is intended that the proposed trail network will be subject to the criteria of the New Zealand Mountain Bike Trail Design & Construction Guidelines (see Appendix A).

### 1.3 Limitations

e3Scientific Limited (e3s) performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental science profession. No warranties, express or implied, are made. The confidence in the findings is limited by the Scope of Work and limited data due to the two days of site visits, at one time of year. A full range of biota that are present at this site may not have been seen or recorded. Desktop research was utilised to aid the assessment.

The results of this assessment are based upon site inspections conducted by e3s personnel, and existing desktop information. All conclusions and recommendations regarding the assessment are the professional opinions of e3s personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, e3s assumes no responsibility or liability for errors in any data obtained from regulatory agencies,



statements from sources outside e3s, or developments resulting from situations outside the scope of this project.

## 2 Methodology

The ecological assessment is based on a desktop study and site visit completed on 1 and 5 May 2023.

### 2.1 Desktop Assessment and Site Visit

The objectives of the desktop assessment and site visit included:

- Establishing the representativeness of the ecological vegetation and habitats present through field survey and a review of the previous Coronet Peak Ecological Assessment (e3scientific, 2019). The assessment included consideration of expected pre-disturbance vegetation and Land Environments of New Zealand (LENZ) classification (Leathwick, *et al.*, 2003).
- Determination of the presence and significance of plant species and habitats through desktop information, botanical survey and review of the Department of Conservation's threat classification for New Zealand indigenous vascular plants (de Lange, *et al.*, 2018).
- Determination of the likely presence and significance of avifauna species through the site visit, existing scientific knowledge, and review of the Department of Conservation's threat classification for New Zealand birds (Robertson *et al.*, 2021).
- Determination of the likely presence and significance of herpetofauna species through the site visit, existing scientific knowledge, and review of the Department of Conservation's threat classification for New Zealand's reptiles (Hitchmough *et al.*, 2021).

### 2.2 Ecological Impact Assessment

The assessment of ecological effects for the study area has been completed using the Environment Institute of Australia and New Zealand Ecological Impact Assessment guidelines (Roper-Lindsay *et al.*, 2018, hereafter "EciA guidelines"). The impact assessment follows the steps outlined below:

- The ecological values for the site have been described. These are detailed in Section 3 of this report.
- Ecological values are assigned a score on a continuum scale of Negligible to Very High. These scores are based on an assessment against criteria

which are set out in the EclA guidelines. The ecological value scores and the rationale are described in Section 4 of this report.

- Determination of the magnitude of the effect that the activity has on the ecological values. The scale of the magnitude also ranges from Negligible to Very High. The magnitude of effect scoring and the rationale for this activity is detailed in Section 5.1 of this report.
- The overall level of effect is then determined by a combination of ecological value and the magnitude of the effect. Level of effect categories include Net Gain, Very Low, Low, Moderate, High and Very High. The Level of Effect scores are detailed in Section 5.2 of this report, with summary of effect detailed in Section 5.3.
- Note the Magnitude of Effect and Level of Effect scores are influenced by the measures that can be taken to avoid, remedy or mitigate effects. Recommendations are detailed in sections 5 and 6.

## 3 Existing Environment

### 3.1 Historical Context

Prior to 1955, Coronet Peak Recreational Reserve was part of Coronet Peak Station, a large amalgam of several pastoral leases and other rural properties. The gazettement of the area as Coronet Peak Recreation Reserve occurred in 1986. Skiing is recorded as having occurred here from about 1939 and Coronet Peak opened as New Zealand's first commercial ski-field in 1947. Further history is described in e3s' 'Coronet Peak Lease Application Ecological Assessment' (e3scientific, 2019).

### 3.2 Environmental Context

The study area is located predominantly within the existing ski field extent on south facing slopes. Two trails extend below the established ski field boundary in a southerly direction. The site is located within the Shotover Ecological District of the Lakes Ecological Region (DOC, 2023). Under the Queenstown Lakes District Plan the area is zoned Coronet Peak Ski Area Sub-Zone (QLDC, 2017). The majority of the study area (within CPRR) is located within the lowest threatened environment category, with the indigenous vegetation cover containing greater than 30% of its original extent and more than 20% under formal protection for natural heritage values.

### 3.3 Physical Environment

Tracks are proposed across the altitudinal range of the study area from approximately 840 m asl at its lowest point, to approximately 1651 m asl at the top of Coronet Peak. The area includes a variety of topographical and geographical features associated with the hummocky terrain, including hills and depressions of variable sizes and shape, rocky outcrops, exposed ridges, tarns and moderately steep sided watercourses and springs. Modification of the topography has occurred during the construction of the mountain biking trails, ski field trails, buildings and snow making equipment.

The geology of the area is Aspiring Lithologic Association TZIV pelitic schist (Rakaia Terrane) consisting predominantly of very well segregated and laminated;

abundant pelitic and subordinate psammitic greyschist; minor greenschist and metachert; TZIV (GNS, 2022).

### 3.4 Biological Environment

The pre-human vegetation cover of the study area would have comprised mountain beech (*Fuscopora cliffortioides*) forest below approximately 1100 m asl grading into subalpine *Dracophyllum* shrubland mixed with tall tussocks (*Chinochloa rigida* being replaced by *Chinochloa macra* above approximately 1400 m asl) above treeline. Isolated cushion fields, fellfield and rocky outcrops would have been present consisting of but not limited to *Raoulia* spp., *Hectorella caespitosa*, *Dracophyllum muscoides* and extensive herbs and low growing Veronica spp. (*V. densifolia* and *V. bachanani*) on exposed terrain and higher sunlight aspects. Wetlands and tarns persisted within larger catchment gulley's, being fed predominantly by snow melt cycles.

Historic disturbance within the study area as well as more recent use as a ski field has seen exotic species introduced including browntop (*Agrostis capillaris*), sweet vernal (*Anthoxanthum odoratum*) and *Hieracium* spp. which extends throughout the altitudinal range of the CPRR. Where forest is absent tussock grassland extends to lower altitudes containing blue tussock (*Poa colensoi*)-hard tussock (*Festuca novae-zelandiae*)-exotic grass associations. At lower altitudes large areas are converted to pasture (Leathwick et al., 2003).

## 4 Ecological Values

### 4.1 Terrestrial vegetation

The vegetation present at the site can be classified into six different communities. The dominant community is dracophyllum/tussock shrubland, however, dracophyllum/tussock/celmisia shrubland, rocky summit, wetlands, cushionfields tussock/exotic grassland and exotic species and habitat are also present. The vegetation communities are described below and in Figure 3. Exotic weed and grass species were present in all habitats.

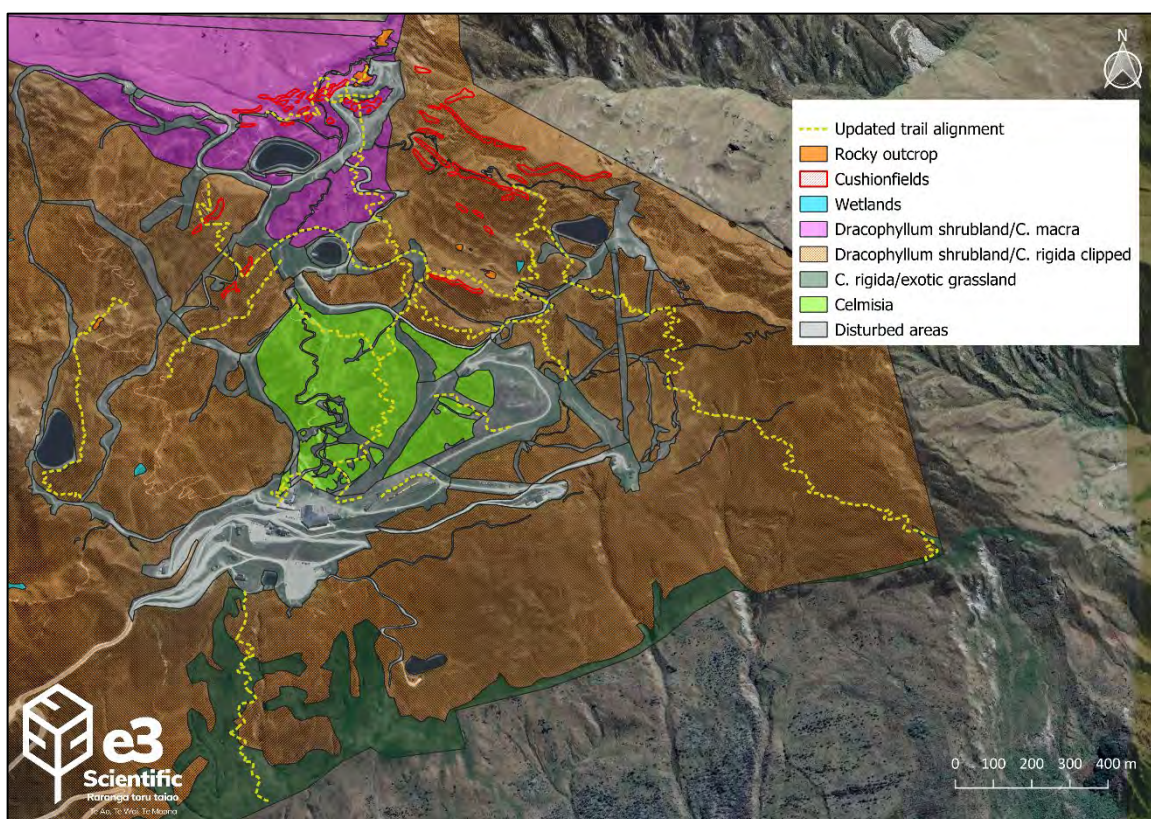


Figure 3: Map of vegetation communities within the study area and areas of disturbed land.

#### 4.1.1 *Dracophyllum* - Tussock Shrubland

*Dracophyllum*/tussock shrubland is the dominant vegetation present throughout the Reserve (see Figure 3 and Plate 1). This vegetation community varies in the composition of the dominant species. Above approximately 1500 m asl, *Chionochloa macra* prevails, whereas *Chionochloa rigida* is present over the remaining area of the Reserve. Notwithstanding this, there is a transition zone where *C. macra* can extend to lower elevations and vice versa. Wilding conifer

seedlings were present in low numbers at lower elevation, however, control of these two species across the reserve was evident.

*Dracophyllum rosmarinifolium*, *Dracophyllum pronum* and *Chionochloa* spp. are the dominant species however, a diverse range of other indigenous species are also present including *Celmisia lyallii*, *Poa Colensoi*, *Veronica hectorii*, *Ozothamnus vauvilliersii*, *Gaultheria depressa* var. *novae zealandiae*, *Aciphylla kirkii*, *Huperzia australiana*, *Kelleria childii*, *Brachyglottis bellidioides*, *Pimelea oreophila*, *Geranium brevicaule*, *Raoulia subsericea*, *Luzula rufa* var. *rufa*, *Anisotome flexuosa*, *Brachyscome montana*, *Ourisia glandulosa*, *Ourisia caespitosa*, *Wahlenbergia albomarginata*, *Raoulia grandiflora*, *Austrolycopodium fastigiatum*, *Viola cunninghamii*, *Geum leiospermum*, *Lagenophora pumilia*, and *Kelleria dieffenbachii*. Isolated patches of *Celmisia gracilentia*, *Coprosma atropurpurea*, *Acaena saccaticupula*, *Lobelia linnaeoides*, *Styphelia nesophila*, *Plantago lanigera*, *Euphrasia zelandica*, *Lichenomphalia* sp., *Gentianella corymbifera*, and *Leptinella pectinata* were also present. At lower elevations *Ozothamnus vauvilliersii*, *Veronica hectorii* and *Gaultheria crassa* become more prominent. *Brachyglottis cassinioides* is also present in patches at lower elevations. Scattered within the native plants is the exotic weed species *Hieracium lepidulum*, *Pilosella officinarum* and *Plantago lanceolata*.

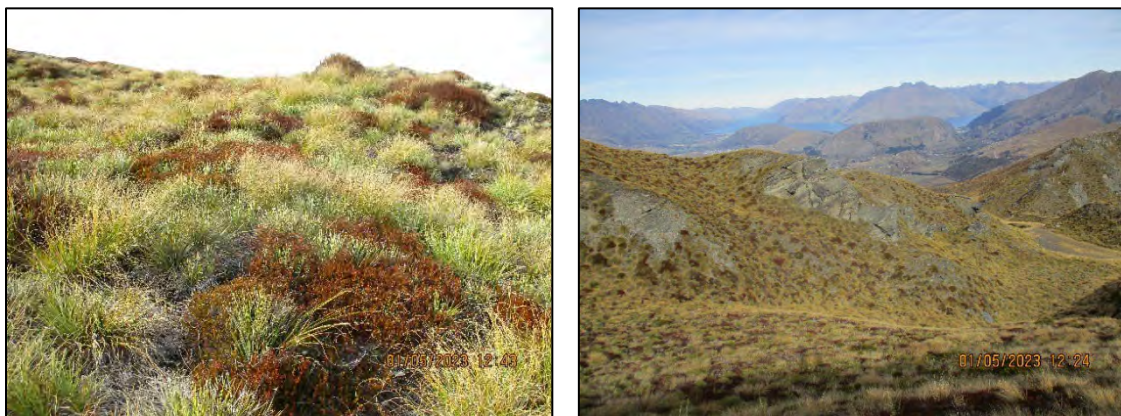


Plate 1: Example dracophyllum -tussock shrubland.

#### 4.1.2 *Dracophyllum* – Tussock - *Celmisia* Shrubland

The area of *dracophyllum* shrubland that is located above the base building and between the main ski trails (see Figure 3 and Plate 2) has a higher proportion of *Celmisia lyallii*. This area is also scattered with blue tussock, snow tussock and *Veronica hectorii*. The increased presence of *Celmisia lyallii* in this area is noticeable, and most likely attributable to the higher level of historic and current disturbance that has occurred.



Plate 2: Co-dominant *Dracophyllum* spp. and *Celmisia lyallii* located near the base building and between the main ski trails.

#### 4.1.3 Rocky Outcrop

Rocky outcrop plant communities are present in small pockets over the Reserve, however the main area is around the summit of Coronet Peak (see Plate 3). This area has a wide range of species, which is a result of soil depth and exposure. Species found on the rocky summit include *Veronica buechananii*, *Poa colensoi*, *Brachyglottis bellidioides*, *Brachyscome montana*, *Dracophyllum pronum*, *Raoulia hectorii*, *Raoulia subsericea*, *Ourisia glandulosa*, *Ourisia caespitosa*, *Gaultheria depressa* var. *novae-zealandiae*, *Celmisia angustifolia*, *Dracophyllum muscoides*, *Epilobium purpuratum*, *Thamnotia vermicularis* var. *vermicularis*, *Anisotome flexuosa*, *Acaena saccaticupula*, *Austrolycopodium fastigiatum*, *Luzula rufa* var. *rufa*, *Luzula pumila*, *Wahlenbergia albomarginata*, *Styphelia nesophila*, *Veronica densifolia*, *Festuca novae-zealandiae*, *Melicytis alpinus*, *Rytidosperma pumilum*, *Raoulia grandiflora*, *Austroblechnum penna marina* subsp. *alpina*, *Raoulia glabra*, *Leptinella pectinata*, *Kelleria dieffenbachia*, *Myosotis pulvinaris*, and *Colobanthus Buchananii*. The rocky outcrop vegetation incorporates species that are found in the cushion fields (see below) but also contains species that are not widespread such as *Epilobium purpuratum* which is Naturally Uncommon and the rush, *Marsippospermum gracile*, which is only present in patches.





Plate 3: Coronet Peak rocky outcrop habitat.

#### 4.1.4 Cushionfield

The cushion fields within the Reserve are typically found in small, narrow strips on exposed ridges and spurs in the upper elevations of the Reserve (see Figure 3 and Plate 4). These communities have been developed in response to high wind and sun exposure with relatively shallow soil depths. Species within these communities include *Dracophyllum muscoides*, *Raoulia hectorii*, *Raoulia grandiflora*, *Raoulia subsericea*, *Carex brevicaulmis*, *Hectorella caespitosa*, *Poa colensoi*, *Luzula pumila*, *Luzula rufa* var. *rufa*, *Rytidosperma pumilum*, *Colobanthus bachananii*, *Kelleria childii*, *Leptinella pectinata*, *Celmisia sessiflora*, *Celmisia gracilentia*, *Myosotis pulvinaris*, *Wahlenbergia albomarginata*, *Abrotanella inconspicua*, *Ourisia glandulosa*, *Ourisia caespitosa*, *Veronica densifolia* and *Celmisia laricifolia*, with *Gunnera denata* in locally damp areas. Larger species such as *Veronica buechananii*, *Anisotome flexuosa*, *Gaultheria depressa* var. *novae-zealandiae*, *Pimelia oreophila* and *Acaena saccaticupula* are also present.

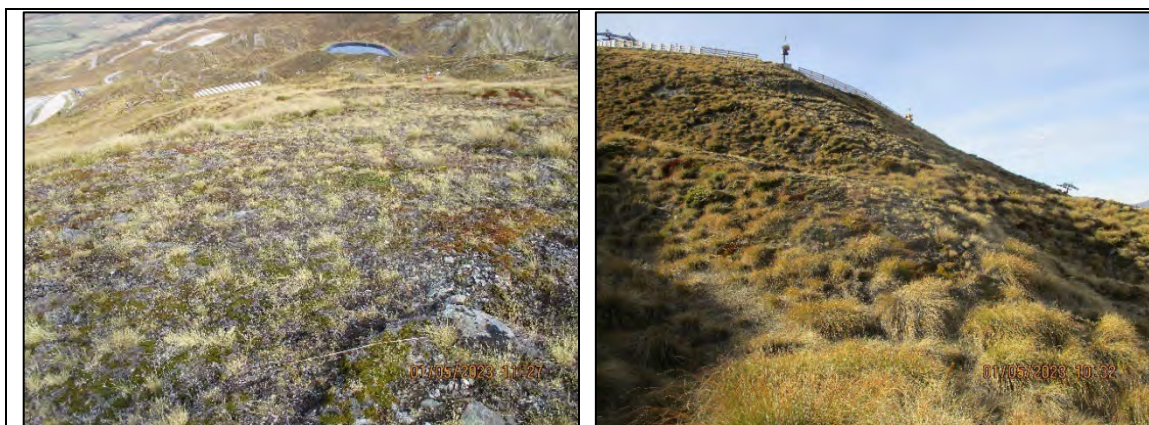


Plate 4: Cushion field habitat. Left – close up of large lower altitude cushion field. Right – location of cushion field habitat along the tops of the exposed ridges and spurs, with adjacent tussock grassland.

#### 4.1.5 Wetlands, Tarns, Streams and Seepages

A number of wetlands are present across the study area including tarns, multiple streams and seepage areas (see Figure 3 and Plate 5). The wetlands and seepages vary from cushion wetlands dominated by comb sedge (*Oreobolus pectinatus*) with a range of small herbs and wetland plants to *Schoenus pauciflorus* dominated sedge lands. The wetlands are small in area and predominantly found on the western side of the Reserve. Species present include *Marsippospermum gracile*, *Abrotanella caespitosa*, *Ranunculus gracillipes*, *Nertera balfouriana*, *Carex gaudicaudiana*, *Juncus edgariae*, *Caltha obtusa*, *Coprosma perpusilla*, *Plantago unibracteata*, *Cardamine corymbosa*, *Anisotome aromatica*, *Ourisia caespitosa*, mosses and lichens. *Dolichoglottis lyallii*, *Anaphalioides bellidioides*, and *Viola cunnghamii* were found along the stream and seepage margins, and *Coprosma rugosa* at lower elevations along the steep creek banks.



Plate 5: Left – Alpine tarn near lower Whakatipu view proposed trail. Right – Riparian wetland near ka kite ano proposed trail.

#### 4.1.6 Tussock – Exotic Grassland

This community is predominantly located below the NZ Ski base building extending downslope towards the CPRR's southern boundary. The area is within the subalpine – original treeline transitional zone and as such many of the species within the dracophyllum and tussock communities are present, with the addition of less hardy inter-tussock herbs and shrubland species. The area has experienced a higher degree of disturbance than those within the upper ski areas and as a result exotic grass species are more prominent yet are still not the dominant vegetation.

Native species present include *Chinochloa rigida*, *Pentachondra pumila*, *Kelleria dieffenbachia*, *Coprosma cheesemanii*, *Pimelea oreophila*, *Styphelia nesophila*, *Galium perpusillum*, *Gaultheria crassa*, *Veronica decora*, *Euphrasia zelandica*, *Aciphylla aurea*, *Raoulia haastii*, *Ranunculus multiscarpus*, *Luzula rufa* var. *rufa*, *Ourisia caespitosa*, *Lagenophora pumila*, *Lobelia linnaeoides*, *Veronica densifolia*, *Celmisia gracilentia*, *Raoulia glabra*, *Acaena saccaticupula*, *Dracophyllum pronum*, *Wahlenbergia albomarginata*, *Gentianella corymbifera*, *Anisotome flexuosa*, *Brachyglottis bellidioides*, *Ozothamnus vauvilliersii*, *Poa cita*, *Poa colensoi*, *Viola cunninghamii*, *Veronica hectorii*, *Celmisia lyallii*, *Austrolycopodium fastigiatum*, *Styphelia nesophila*, *Raoulia subsericea*, *Gaultheria depressa*, *Acipylla kirkii*, *Anaphalioides bellidioides* and *Dracophyllum muscoides*. Scattered *Dracophyllum longifolium*, *Brachyglottis cassinioides* and *Veronica odora* were also present.

Exotic species intermixed within the community included, *Rumex acetosella*, tussock hawkweed (*Hieracium lepidulum*), *Plantago lanceolata*, *Hypochaeris radicata*, mouse-ear hawkweed (*Pilosella officinarum*), scotch thistle (*Onopordum acanthium*), briar (*Rosa rubiginosa*), brown top (*Agrostis capillaris*), white clover (*Trifolium repens*), yarrow (*Achillea millefolium*), sweet vernal (*Anthoxanthum odoratum*). *Pinus* sp. seeding becomes more abundant at lower elevations and are scattered across the lower faces.



Plate 6: Photos showing transitional vegetation zone.

#### 4.1.7 Disturbed vegetation

Exotic species are widely spread over the Coronet Peak Recreation Reserve. Exotic species are the dominant vegetation on the ski trails as well as any disturbed ground (see Plate 6). Common weed species present include brown top (*Agrostis capillaris*), white clover (*Trifolium repens*), yarrow (*Achillea*

*millefolium*), sweet vernal, tussock hawkweed, mouse-ear hawkweed, creeping thistle (*Cirsium arvense*), broad leaved dock (*Rumex obtusifolius*) and sheep sorrel (*Rumex acetosella*). Brown top and white clover are present within most of the vegetation communities but are at low levels in the *Dracophyllum* shrublands to the west of the ski area.

The regeneration of native species on the disturbed areas such as the ski trails is more evident at higher elevations, where the exotic grass mix was less successful in striking (see Plate 7). The presence of bare soil has enabled native species to colonise disturbed sites. Native species which are spreading over these bare areas include *Raoulia tenuicaulis*, *Raoulia youngii*, *Acaena saccaticupula*, *Poa colensoi*, *Rytidopserma pumilum*, *Epilobium* spp. In one location the Nationally Vulnerable, small rosette *Myosotis elderi* is present. In the lower elevations, such as on the Big Easy trail, where the exotic species have formed a thick cover, regeneration of native species is much lower.



Plate 7: Regenerating native and exotic dominant vegetation communities, characteristic of disturbed areas within the CPRR.

#### 4.1.8 Notable plant species

*Epilobium purpuratum* is known from the rocky summit community of Coronet Peak.

*Brachyscome montana*, was present in the *Dracophyllum* tussock shrubland, rocky outcrop and cushion field communities.

*Myosotis elderi* was present at one location within the regenerating disturbed areas.

*Myosotis pulvinaris* although Not Threatened is locally sparse (within the recreation reserve) inhabiting cushion field and rocky outcrops near the summit.

## 4.2 Terrestrial Fauna

The native bird species that are known to use the site are detailed in Table 2 below. The likelihood of occurrence ranges from low – high and is based upon previous site visits, desktop assessment and professional knowledge with regard to species preference of onsite habitats. Introduced passerine and land fowl species are known from the area however, exotic species do not hold any ecological value under the assessment criteria and have subsequently not been assessed further within this report.

Lizard species that may be present are also detailed in Table 2. Other species of skink with specific habitat requirements may also be present, however a dedicated herpetofauna survey has not been undertaken. Rocky and shrubby habitat suitable for more lizard species was not observed, however may be more common at lower altitudes.

Table 2: Native avifauna and herpetofauna presence at the site.

Common name <b>Scientific name</b>	Conservation Status <sup>1</sup>	Likelihood of Occurrence	Notes
Eastern falcon/ <b>kārearea</b> ( <i>Falco novaeseelandiae novaeseelandiae</i> )	At Risk - recovering	High	Suitable habitat over the site. Observed during both site visits
Kea ( <i>Nestor notabilis</i> )	Nationally Endangered	Low - Moderate	Some suitable habitat for seasonal foraging is present. However, nesting habitat is limited and the level of disturbance is likely to deter continuous use. Sightings are uncommon at similar elevations within the wider Whakatipu basin.
Australasian harrier / <b>kāhu</b> ( <i>Circus approximans</i> )	Not Threatened	High	Suitable habitat present. Observed on site visit in all habitats.
NZ pipit/ <b>pīhoihoi</b> ( <i>Anthus novaeseelandiae novaeseelandiae</i> )	At Risk - Naturally uncommon	High	Suitable habitat present. Large group of 20 or more was observed on a site visit in May 2023.
Paradise shelduck/ <b>pūtangitangi</b> ( <i>Tadorna variegata</i> )	Not threatened	High	Utilise snow-making reservoirs and rocky ridges.

McCann's skink <b>(<i>Oligosoma maccanni</i>)</b>	Not threatened	High	Extensive available habitat. Observed during 2019 site visit
Southern grass skink <b>(<i>Oligosoma polychroma</i> Clade 5)</b>	At Risk - Declining	High	Extensive available habitat. Observed during 2019 site visit
Cryptic skink ( <i>Oligosoma inconspicuum</i> )	At Risk - declining	Moderate	Within the distribution of this species. Suitable habitat is present within ski field area, survey not undertaken.
Short-toed gecko ( <i>Woodworthia</i> "southern mini") or Korero gecko ( <i>Woodworthia</i> "Otago/Southland large")	Not threatened	Moderate	Within the distribution and habitat of these common gecko species. Suitable habitat not observed but may be present, survey not undertaken. May be more common at lower altitude areas of the site.
Orange-spotted gecko (Mokopirirakau "Roys Peak")	At Risk - declining	Low	Uncommon but known from similar high altitudes nearby on the crown range. Suitable habitat not observed but may be present, survey not undertaken.

Lines in bold were observed in 2019 and/or 2023 site visit.

<sup>1</sup> Conservation status as per Robertson *et al.* (2017) or Hitchmough *et al.* (2021)

A wide range of invertebrates have been recorded in the Coronet Peak Pastoral Lease area which includes the alpine zone of Coronet Peak Recreation Reserve, and down the faces below the ski field (DOC, 2006). This survey recorded 390 species of invertebrates including 289 moth species. The area supports a diverse invertebrate fauna including grasshoppers, worms, butterflies, moths, spiders, crickets, flies, beetles and weta.

Introduced mammals such as mice, rats, hares, ferrets, stoats and hedgehogs are present. There is a network of approximately 55 traps in the ski field area targeting some of these pests.

Further information regarding the terrestrial fauna is detailed in e3scientific (2019).

### 4.3 Freshwater Values and NES-F Regulations

There are multiple unnamed wetland, ephemeral and perennial streams within the study area. The proposed trail alignment crosses these streams in four locations (see Figure 4). The proposed trails have been amended in consultation with e3s to minimise any disturbance on onsite wetlands. Following these changes, no earthworks or vegetation clearance is proposed within 10 m of any potential wetland habitat (mapped wetlands that e3s are confident will meet the threshold of a natural inland wetland under the Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-F)). This being said, trails are located within 100 m of the mapped wetlands and are within the

catchment area of some of the mapped wetlands. As such, earthworks and vegetation clearance are subject to Regulation 54 (c) of the NES-F (see Figure 6). Although additional wetlands are present, only those relevant to the proposed trail construction are shown in Figure 4 and Figure 5.



Figure 4: Location of freshwater values – eastern locations.



Figure 5: Location of freshwater values – western locations.

*Other activities*

**54 Non-complying activities**

The following activities are non-complying activities if they do not have another status under this subpart:

- (a) vegetation clearance within, or within a 10 m setback from, a natural inland wetland:
- (b) earthworks within, or within a 10 m setback from, a natural inland wetland:
- (c) the taking, use, damming, or diversion of water within, or within a 100 m setback from, a natural inland wetland if—
  - (i) there is a hydrological connection between the taking, use, damming, or diversion and the wetland; and
  - (ii) the taking, use, damming, or diversion will change, or is likely to change, the water level range or hydrological function of the wetland:
- (d) the discharge of water into water within, or within a 100 m setback from, a natural inland wetland if—
  - (i) there is a hydrological connection between the discharge and the wetland; and
  - (ii) the discharge will enter the wetland; and
  - (iii) the discharge will change, or is likely to change, the water level range or hydrological function of the wetland.

Regulation 54(a): amended, on 5 January 2023, by [regulation 30\(1\)](#) of the Resource Management (National Environmental Standards for Freshwater) Amendment Regulations (No 2) 2022 (SL 2022/320).

Regulation 54(b): amended, on 5 January 2023, by [regulation 30\(1\)](#) of the Resource Management (National Environmental Standards for Freshwater) Amendment Regulations (No 2) 2022 (SL 2022/320).

Regulation 54(c): replaced, on 5 January 2023, by [regulation 30\(2\)](#) of the Resource Management (National Environmental Standards for Freshwater) Amendment Regulations (No 2) 2022 (SL 2022/320).

Regulation 54(d): inserted, on 5 January 2023, by [regulation 30\(2\)](#) of the Resource Management (National Environmental Standards for Freshwater) Amendment Regulations (No 2) 2022 (SL 2022/320).

Figure 6: Regulation 54 of the Resource Management (National Environmental Standards for Freshwater) Regulations 2020.



### 4.3.1 Stream Crossings

NZ Ski propose to establish bridges across all four locations in order to avoid direct disturbance of the streams substrate. Bridges 2,3 and 4 are proposed to be small removable bridges that will only be in place during the summer season. Bridge 5 is proposed to be a permanent structure for the proposed ka kite ano trail to pass over an unnamed perennial stream that feeds a riparian wetland approximately 30 m downstream of the proposed bridge location.

As no direct disturbance of the stream beds are proposed no additional consents are required under the NES-F.

### 4.3.2 Wetland habitat within 100 m of tracks

#### Alpine Tarn

The alpine tarn (see Figure 4) is a glacially formed and predominantly snow fed wetland. The natural formation of earth bank retains water whilst allowing snowmelt to exit the tarn into a small gully. The gully is contained and does not have an overland flow path. The catchment of the tarn is very small, and no additional wetlands have formed as a result of water exiting the tarn. The amended trail alignment is approximately 11 m from the tarns closest point. It traverses the slope above the tarn before crossing a removal bridge (bridge 1, see Figure 4) located downgradient of the tarns outflow point. The bridge is proposed to cross the channel without disturbing any vegetation or earth within the substrate. The trail is then proposed to follow a small ridge before traversing the lower slopes of the larger gully.

As the tarn is predominantly snow fed and has a very limited catchment above, the proposed earthworks and vegetation removal is highly unlikely to change the water level range or hydrological function of the wetland. As such the trail construction within this area is considered a permitted activity.

#### Wetland seepage 1

This wetland habitat has formed as a result of localised water table uplift. The trails in the area are outside the direct catchment and are unlikely to contribute any runoff into the wetland. The trail depth is proposed to a depth of approximately 30 cm within the adjacent area and is highly unlikely to alter the water level range

or hydrological function of the wetland. As such the trail construction within this area is considered a permitted activity.

#### Wetland seepage 2

This wetland habitat has formed as a result of localised water table uplift. However, the areas water table has been exasperated by a pipeline discharge to the area. The wetland outflow is a channelised intermittent stream forming riparian wetlands downslope (see Figure 5). The amended trail alignment is proposed to traverse on the eastern slope at a minimum distance greater than 10 m from any potential wetland feature. The trail will not alter the water level range or hydrological function of the wetland. As such the trail construction within this area is considered a permitted activity.

#### Riparian Wetland 1

This wetland habitat has formed as a result flow from 'wetland seepage 1' being connected by small stretch of an intermittent stream. Additional water is feed from groundwater uplift accumulated from the large gully to the north and east. The amended trail alignment is within 10 m of the wetland, however, where this is the case, the trail will remain on the existing access track and no additional earthworks or vegetation clearance are proposed within this area. The additional trails within 100m of the wetland are on faces that contribute minimal overland flow. As such the proposed trials are highly unlikely to alter the water level range or hydrological function of the wetland. As such, the trail construction within this area is considered a permitted activity.

#### Riparian Wetland 2

This wetland habitat has formed as a result overland flow and snow melt from a large catchment of lower transpiring, south facing slopes forming a perennial stream from the head of a prominent critical source area. The area is likely aided by an uplift of groundwater to the area. The amended trail proposal intends to intersect the stream at a narrow section approximately 30 m below the head of the gully and 30 m above the wetland location. This area contributes a minimal amount of water to the receiving wetland and is highly unlikely to alter the water level range or hydrological function of the wetland. As such the trail construction within this area is considered a permitted activity.

## 4.4 Summary of Ecological Values

The areas of ecological value are associated with the cushionfield, tussock grassland/dracophyllum shrubland, tussock/exotic grassland, wetland, rocky outcrops, and indigenous vegetation within disturbed areas, as well as individual species. The communities present range in condition from semi-natural and regenerating to highly natural.

## 5 Ecological Significance and Value

The assessment of significance of the ecological values associated with the Coronet Peak Recreation Reserve are based on the following:

- The QLDC District Plan Chapter 33 Criteria for assessing ecological significance;
- The Ecological Impact Assessment (EclA) EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems, 2nd edition (Roper-Lindsay *et al.*, 2018); and,
- New Zealand's Department of Conservation threatened flora and fauna series.

### 5.1 Significance of Flora and Vegetation

Table 3 summarises the assessments against the EclA and QLDC criteria and is provided below. The full table including rationale for each assessment matter is provided in Appendix B.

In summary, the site has a range of vegetation communities. All of the communities satisfy the significance criteria under the QLDC District Plan and have an overall ecological value under the EIANZ Guidelines ranging from Low to Very High.

Table 3: Communities associated value and significance.

Community	Criteria	Representativeness	Rarity	Distinctiveness	Diversity and Pattern	Ecological Context	Overall
Dracophyllum - tussock shrubland	EclA Score	Moderate	Low/Moderate*	Low	High	Very High	High
	QLDC Criteria	Yes	No	No	Yes	Yes	Yes
Dracophyllum - tussock - celmisia Shrubland	EclA Score	Moderate	Low	Low	Moderate	Moderate	Moderate
	QLDC Criteria	Yes	No	No	No	Yes	Yes
Rocky outcrop	EclA Score	High	Moderate	Moderate	High	Moderate	High
	QLDC Criteria	Yes	Yes	Yes	Yes	Yes	Yes
Cushionfield	EclA Score	Very High	Moderate	Moderate	High	High	Very High
	QLDC Criteria	Yes	Yes	Yes	Yes	Yes	Yes
Wetland	EclA Score	Very High / Low*	High	High	Very High / Low*	Very High	Very High / High*
	QLDC Criteria	Yes/No*	Yes	Yes	Yes / No*	Yes	Yes
Tussock – exotic grassland (Transitional Zone)	EclA Score	Moderate	Low	Low	Moderate	Moderate	Moderate
	QLDC Criteria	Yes	No	No	Yes	Yes	Yes
Disturbed vegetation	EclA Score	Low	Low / Very High*	Low	Low	Low	Low / Moderate*
	QLDC Criteria	No	No/Yes*	No	No	No	No / Yes*

\* Does not apply across all locations (see Appendix B for further detail).

### 5.1.1 Notable Plant Values

Most of the indigenous species present at the site are classified as “not threatened”. Following the EclA guidelines nationally and locally common indigenous species are assigned a Low ecological value.

*Myosotis elderi* has a threat ranking of “Threatened – Nationally Vulnerable” giving an ecological value of Very High.

*Epilobium purpuratum* has a threat ranking of “At risk – naturally uncommon” giving an ecological value of Moderate.

*Brachyscome montana* has a threat ranking of “Data Deficient”. This does not qualify for an increased ecological value. However, a “low” ecological value is assigned to species that are nationally and locally common. One of the qualifiers for a “moderate” ecological value is locally uncommon or distinctive species (EclA, 2018). *Brachyscome montana* is notable and distinctive locally, therefore e3scientific considers an ecological value of Moderate is appropriate.

## 5.2 Significance of Terrestrial Fauna Values

### 5.2.1 Terrestrial Invertebrates

It is expected that a full range of invertebrates are present at the site. Some species described in DOC (2006) are “At Risk” or distinctive due to being notable in the Ecological District and Otago, or with type localities nearby. The ecological value score for terrestrial invertebrates therefore varies from Negligible (exotic invertebrates) through to High (threatened species).

A summary of the ecological value score for terrestrial invertebrates that may be present is detailed in section 5.3.

### 5.2.2 Herpetofauna

The lizard species known to be present are the McCann’s skink (not threatened) and the southern grass skink (At Risk – Declining). Other common and threatened species may be present. The assigned ecological value under the EclA guidelines

for species with the respective conservation statuses are High and Low, respectively. These ecological values also apply should other unconfirmed species be present.

A summary of the ecological value score for herpetofauna that may be present is detailed in section 5.3.

### 5.2.3 Avifauna

The threat status of native birds that may utilise the site are listed in Table 2. The EclA guidelines assign the following values based on threat class:

- Threatened – Very High
- At Risk – Declining – High
- At Risk (any other category), locally uncommon and data deficient – Moderate
- Nationally common and not threatened – low

A summary of the ecological value score for avifauna is detailed in Section 5.3.

### 5.2.4 Introduced fauna

The assigned ecological value under the EclA guidelines for species that are introduced fauna is Negligible.

## 5.3 Summary of Ecological Value Scores

The vegetation and habitat within the site has been assessed using the criteria outlined in the EclA guidelines. Table 4 summarises this assessment with the rationale described in sections 5.1 and 5.2 above.

Table 4: EclA ecological value scores for flora and fauna

Description	Ecological Value Score
Dracophyllum-Tussock shrubland community	High
Dracophyllum-Tussock-Celmisia shrubland community	Moderate
Rocky Summit community	High
Cushionfield community	Very High
Wetlands	Very High/High

Tussock – Exotic Grassland (Transitional Zone)	Moderate
Disturbed Areas community	Low/Moderate
Terrestrial Invertebrates At Risk – Declining for relevant species that are described in DOC (2006)	High
Terrestrial Invertebrates At Risk Other Categories, locally uncommon or distinctive for relevant species that are described in DOC (2006)	Moderate
Terrestrial Herpetofauna At Risk – Declining Southern grass skink <i>Oligosoma</i> aff. <i>polychroma</i> Clade 5, other species if present.	High
Avifauna Threatened – Nationally Endangered & Nationally Vulnerable Kea ( <i>Nestor notabilis</i> ) and Eastern falcon ( <i>Falco novaeseelandiae novaeseelandiae</i> )	Very High
Avifauna At Risk – Declining NZ pipit ( <i>Anthus novaeseelandiae novaeseelandiae</i> )	High
Native flora and fauna locally common	Low
Exotic flora and fauna	Negligible



## 6 Ecological Effects

The direct effects of the activity on the vegetation communities are described in Section 6.1 below. The indirect effects are habitat loss, sedimentation, fragmentation and weed encroachment. These are considered in Section 6.2 below. Table 6 in Section 6.3 summarises the magnitude and level of effect scores and recommended mitigation measures.

### 6.1 Direct effects

#### 6.1.1 *Vegetation community disturbance*

Table 5 sets out the direct disturbance of the proposed mountain bike trails to each vegetation community. We estimate the direct disturbance will range between 1 ha to 1.7 ha based on the predicted trail widths set out in Table 1.

Table 5: Vegetation disturbance of each affected community.

Community	Minimum area of disturbance (m <sup>2</sup> )*	Maximum area of disturbance (m <sup>2</sup> )*
Dracophyllum-tussock shrubland	6,174	10,492
Dracophyllum-Tussock-celmisia shrubland	1,045	1,817
Rocky outcrop	42	73
Cushionfield	38	53
Wetland	0	0
Tussock – exotic grassland (Transitional Zone)	667	1,151
Disturbed areas	2,050	3,329
Total	10,016	16,915

\*Minimum and maximum disturbance areas have been calculated based upon the proposed track width as described in Table 1.

#### 6.1.2 *Dracophyllum-Tussock Shrubland*

The disturbance to the dracophyllum tussock community is estimated to be between 6,174 and 10,492 m<sup>2</sup>. Dracophyllum-Tussock shrubland is the most widely distributed vegetation community covering approximately 5,082,339 m<sup>2</sup> within the wider CPRR. Therefore, in regard to the wider ecological context, the proposed clearance will have a minor shift away from baseline conditions. The magnitude of effect is assessed as being Low. The level of effect is subsequently assessed as Low (a High ecological value and Low magnitude of effect). NZ Ski propose that all vegetation removed for the formation of the trails is to be re-established on trail

batters and/or bare surfaces. Additionally, it is recommended that all trails are walked to individually identify and translocate all *Brachyscome montana* to suitable nearby habitat. Provided these mitigation measures are followed the residual effect is assessed as Low.

### 6.1.3 *Dracophyllum-Tussock-Celmisia Shrubland*

The *Celmisia* dominant community is induced due to more historic disturbance compared to other indigenous communities. The area is already highly fragmented, therefore the proposal will only have a minor shift away from the existing conditions. In addition, NZ Ski propose to move all disturbed vegetation to trail batters to reduce vegetation loss. The magnitude of effect is considered Low, resulting in a level of effect that is also Low (a Moderate ecological value and a Low magnitude of effect).

### 6.1.4 *Rocky Outcrop*

Between 42 and 73 m<sup>2</sup> of the rocky outcrop community is proposed to be disturbed. The area within the Ski area has approximately 3,805 m<sup>2</sup> of mapped rocky outcrop habitat. The proposed clearance will result in the disturbance of approximately 1.1 – 1.9% of the total mapped rocky outcrop habitat. Given the presence of *Brachyscome montana* and *Epilobium purpuratum* the magnitude of effect is assessed as being High without any mitigation measures. The level of effect is subsequently assessed as Very High (High ecological value and High magnitude of effect). NZ Ski propose mitigate the ecological effects by relocating all indigenous vegetation disturbed for the purpose of trail construction to suitable nearby habitat. Additionally, it is recommended that all trails are walked to individually identify and translocate all *Brachyscome montana* and *Epilobium purpuratum* to suitable nearby habitat. Provided the mitigation measures are adhered to the residual effect is subsequently re-assessed as being Low.

### 6.1.5 *Cushionfield*

The cushion field community is proposed to be disturbed in two locations where the trail intersects the community either side of a turn. The trail alignment has been adjusted prior to the assessment, to avoid additional areas of cushion fields. The areas of cushion field proposed to be disturbed account for between 38 – 53 m<sup>2</sup>. The wider CPRR contains 23,383 m<sup>2</sup> of mapped cushion fields. As such, the

proposed disturbance accounts for between 0.17 – 0.23 % of the total cushion field habitat. Given the presence of *Brachyscome montana*, the magnitude of effect without mitigation is assessed as Moderate. The level of effect is subsequently assessed as High (Very High ecological value and Moderate magnitude of effect). NZSki propose to reinstate all disturbed vegetation along the trail batters. Additionally, it is recommended that all trails are walked to individually identify and translocate all *Brachyscome montana* to suitable nearby habitat. Based on the scale of the disturbance and provided all mitigation measures are adhered to, the residual effect is re-assessed as Low.

#### 6.1.6 Wetlands

The trail alignment has been adjusted in consultation with e3s, prior to the completion of the impact assessment. The proposed trail alignments do not come within 10 m of wetlands, and hydrological impacts have been considered (see Section 4.3.2). No direct disturbance of wetland vegetation is proposed and therefore does not require further assessment. Indirect effects of earthworks within 100 m are detailed in Section 6.4.

#### 6.1.7 Tussock – Exotic Grassland (Transitional Zone)

The proposal is likely to result 667 – 1151 m<sup>2</sup> of vegetation disturbance. 253,249 m<sup>2</sup> of transitional vegetation has been mapped below the ski field extent. The proposal will result in the disturbance of between 0.3 and 0.5 % of the total community cover within the CPRR. The clearance is therefore assessed as having a minor shift in baseline conditions, resulting in a Low Magnitude of effect. The level of effect is subsequently assessed as being Low (a Moderate ecological value and a Low ecological effect).

#### 6.1.8 Disturbed Areas

This community is highly modified. Where indigenous species are present, they are early successional species that commonly revegetate bare surfaces following disturbance. Where the Threatened *Myosotis elderii* is not present, the proposal is considered to be a very slight change from baseline conditions that will barely be distinguishable from the disturbed trails that are currently present. The magnitude of effect is therefore considered to be Negligible. The level of effect is subsequently assessed as being Very Low. Where the Threatened *Myosotis elderii*

is present, the magnitude of effect is assessed to be High. The level of effect is subsequently assessed as Moderate. To mitigate the ecological effects it is recommended that all trails are walked to identify any *Mysotis elderi* that may be present and either avoid or translocate all specimens to suitable nearby habitat. Provided the recommendation is adhered to the residual effect is reassessed as Low.

## 6.2 Indirect effects

### 6.2.1 Habitat Loss

Kea are considered highly unlikely to utilise any of the habitats more than periodically due to limited suitable habitat being present and the study areas front country proximity. The magnitude of effect is subsequently considered negligible as kea are unlikely to be adversely affected by the proposal. The level of effect is subsequently assessed as Low (a Very High ecological value and Negligible magnitude of effect).

The NZ pipit, McCanns skink and southern grass skink are likely to utilise the Dracophyllum-Tussock shrubland, cushionfields and rocky habitat. Degraded/limited habitat is also present within the Dracophyllum-Tussock-Celmisia shrubland community and Tussock – Exotic Grassland (Transitional Zone). However, the latter is highly unlikely to be utilised due to a lack of rocky or dense tussock cover and limited inter-tussock herbfield species. The scale of the proposal will have a slight shift in baseline conditions given extensive alternative habitat is present. The magnitude of effect for these vertebrates is considered Low. The level of effect is subsequently Low for NZ pipit and the southern grass skink and Very Low for McCann's skink.

Eastern Falcon may utilise all habitat types for hunting/foraging and may utilise rocky outcrops for nesting/breeding. However, falcon are unlikely to nest in the proposed disturbance area (within the rocky outcrop community) due to the elevation and level of human activity in adjacent areas. There is extensive alternative habitat present, and the addition of the proposed trails are a small proportion of their home range. The overall disturbance of falcon habitat is therefore assessed as negligible. The level of effect is subsequently assessed as Low.

The ecological value of terrestrial invertebrates present ranges from Low to Very High. The proposal will have a minor shift away from baseline conditions. Without mitigation, the proposal will have a Low magnitude of effect, resulting in a Low level of effect for species classified as At risk – Declining or lower and a Moderate level of effect for Threatened species. As described above, with regard to vegetation disturbance, it is recommended all areas of indigenous vegetation be re-established on trail batters and bare ground to mitigate the disturbance. Provided successful reestablishment of the communities can occur the loss of habitat will be negligible. Therefore, the residual effects are assessed as Low.

### *6.2.2 Sedimentation*

Streams and wetlands are most susceptible to the effects of sedimentation during and immediately following the proposed earthworks. There is also some risk to all communities during future high rainfall events when excess water can cause scouring and deposition both on and off-track surfaces. The sedimentation has a high magnitude of effect without any mitigation. The level of effect is subsequently assessed as Very High (Very High / High ecological value and high magnitude of effect). It is recommended a site-specific sediment and erosion control plan is completed for streams and wetlands. Resilient track design with adequate batters and runoffs also minimises impacts. Provided these measures are followed the residual effects are re-assessed as Low.

### *6.2.3 Wetland Habitat Dewatering*

The trail alignment has been amended to be greater than 10 m from any potential wetland. Measures to reduce the effects on hydrological function and connectivity of any adjacent areas within the catchment have also been considered (see Section 4.3.2). The magnitude of effect is subsequently assessed as being negligible. No discernible change is expected to be incurred by the wetland habitat, provided a sediment and erosion control measures are implemented, as discussed above. The level of effect is therefore assessed as being Low (High to Very High ecological Value and Negligible magnitude of effect).

#### 6.2.4 Fragmentation

The vegetation communities are already fragmented by the construction of consented mountain bike trails, ski runs, access roads and ski area infrastructure. The addition of the proposed trails are likely to cause a minor shift from the baseline conditions in dracophyllum – tussock shrubland, dracophyllum-tussock-celmisia, rocky outcrop, tussock-exotic grassland and disturbed vegetation communities. The magnitude of effect is therefore assessed as Low within these communities. The level of effect for these areas is assessed as Very Low – Low (Low to High ecological value and a Low magnitude of effect).

In the cushionfield community e3s consider the magnitude of effect of fragmentation to be Negligible. The rationale for this is that proportion of disturbance is very low (0.17 – 0.23 %), the activity is occurring within an area that is already fragmented, and appropriate mitigation measures are proposed. The change to fragmentation will be indistinguishable at this scale and location. The Level of Effect for fragmentation in the cushionfield community is subsequently Low (Very High ecological value with a Negligible magnitude of effect).

#### 6.2.5 Weed introduction and encroachment

Many of the plant communities are dominated by indigenous vegetation with weed species present in areas adjoining trails and disturbed habitat. The activity risks expanding the amount and distribution of exotic species, both during construction and in an ongoing basis. The magnitude of effect of weed introduction is assessed as moderate given the current extent of weed species within the study area. The level of effect without mitigation is assessed as Low – High (Low-Very High ecological value and a Moderate magnitude of effect). It is recommended that prior to any machinery or equipment entering the study area it must be cleaned and checked for soil that could potentially contain seeds or exotic plants that could further contaminate the site. Excavator buckets and tracks are checked and cleaned prior to entering undisturbed vegetation communities. No soil from outside the study area is to be brought onto the site, and no soil is to be moved upslope, particularly from the Lower Lift Station areas. Additionally, a weed management plan for the edges of all relocated vegetation, trails, roads and tracks is to be prepared to ensure that as weeds establish, they are removed annually to prevent further spread into the vegetation. Reporting on the spread and removal of weeds is to be provided

annually to the Department of Conservation. Provided this recommendation is followed the residual effects are assessed as Low.

### 6.3 Summary

Overall, it is assessed that the ecological value of the flora and fauna range from Low to Very High. The proposed trail alignments have been designed to reduce any potential impacts on these values. To ensure the ecological effects from any activities are managed appropriately, e3s recommends that avoidance and mitigation measures are adopted as conditions of approval. If the proposed recommendations are implemented, the overall risk to the ecology of this area from the proposed initial site development is considered Low. Table 6 summarises the potential effects and the associated proposed impact management.

Table 6: Summary of potential ecological effects.

Proposed Activity	Potential Impact	Value Description	Ecological Value	Magnitude of Effect	Level of Effect	Proposed Management Measures	Residual Effect
Earthworks and vegetation clearance	Direct vegetation clearance	Dracophyllum-Tussock shrubland community	High	Low	Low	<ul style="list-style-type: none"> <li>All vegetation removed for the formation of the trails is re-established on trail batters and/or bare surfaces.</li> <li>All trails are to be walked prior to construction, to individually identify and translocate all <i>Brachyscome montana</i> to suitable nearby habitat.</li> </ul>	Low
		Dracophyllum-Tussock-Celmisia shrubland community	Moderate	Low	Low		Low
		Rocky Outcrop community	High	High	Very High	<ul style="list-style-type: none"> <li>All vegetation removed for the formation of the trails is re-established on trail batters and/or bare surfaces.</li> <li>All trails are to be walked prior to construction, to individually identify and translocate all <i>Brachyscome montana</i> and <i>Epilobium purpureum</i> to suitable nearby habitat.</li> </ul>	Low
		Cushionfield community	Very High	Low	Moderate	<ul style="list-style-type: none"> <li>All vegetation removed for the formation of the trails is re-established on trail batters and/or bare surfaces.</li> <li>All trails are to be walked prior to construction, to individually identify and translocate all <i>Brachyscome montana</i> to suitable nearby habitat.</li> </ul>	Low
		Wetlands	High / Very High	Negligible	Low/Very Low		Low
		Tussock – Exotic Grassland (Transitional Zone)	Moderate	Low	Low		Low



		Disturbed areas	Low	Low/High	Low	<ul style="list-style-type: none"> <li>All trails are to be walked prior to construction, to individually identify and either avoid or translocate all <i>Myosotis elderi</i> to suitable nearby habitat.</li> </ul>	Low
Loss of terrestrial fauna habitat		Terrestrial Invertebrates (Threatened)	Very High	Low	Moderate	<ul style="list-style-type: none"> <li>All vegetation removal not already required, is to be re-established on trail batters and/or bare surfaces.</li> </ul>	Low
		Invertebrates (At Risk – Declining At Risk All other Categories)	Moderate / High	Low	Low		Low
		Herpetofauna (At Risk – Declining Southern grass skink <i>Oligosoma</i> aff. <i>polychroma</i> Clade 5)	High	Low	Low	<ul style="list-style-type: none"> <li>If any lizards are observed on site before or during earthworks, work shall cease, and advice be sought from the Department of Conservation regarding permission needed under the Wildlife Act to undertake work in lizard habitat.</li> </ul>	Low
		Avifauna (Threatened – Nationally Endangered, kea <i>Nestor notabilis</i> )	Very High	Negligible	Low		Low
		Avifauna (Threatened eastern falcon <i>Falco novaeseelandiae novaeseelandiae</i> )	Very High	Negligible	Low		Low
		Avifauna At Risk – Declining NZ pipit <i>Anthus novaeseelandiae novaeseelandiae</i>	High	Low	Low	<ul style="list-style-type: none"> <li>Works associated with earth moving or off-track travel must be completed outside the months of August – January to avoid nesting pipit. Alternatively, if this period is unavoidable, authorisation under the wildlife act 1957 must be obtained, or all areas are to be surveyed for nesting avifauna by a suitably qualified ecologist or ornithologist.</li> </ul>	Low

	Sedimentation and erosion	Wetlands and waterways	High /Very High	High	High/Very High	<ul style="list-style-type: none"> <li>A site-specific sediment and erosion control management plan to mitigate the risk of runoff into wetlands, watercourses, and onto neighbouring vegetation is to be prepared and approved prior to works commencing.</li> </ul>	Low
	Wetland dewatering	Wetlands (tarns, seepages and riparian wetlands)	High/Very High	Negligible	Low	<ul style="list-style-type: none"> <li>No earthworks or vegetation removal is to occur in or within 10 m of any wetland. No alteration to the existing flow path, flow direction and the hydrological connection of any wetland is to occur.</li> <li>All temporary and permanent bridge designs are to be approved by a suitably qualified hydrologist prior to construction.</li> </ul>	Low
	Fragmentation	All vegetation communities	Low – Very High	Low/Negligible	Low		Low
	Weed introduction and encroachment	All indigenous vegetation communities	Low – Very High	Moderate	Low – High	<ul style="list-style-type: none"> <li>All machinery is cleaned of outside seeds sources or soils potentially containing exotic seeds.</li> <li>No soil from outside the study area is to be brought onto the site, and no soil is to be moved upslope, particularly from the Lower Lift Station areas.</li> <li>Excavator buckets and tracks are checked and cleaned prior to entering undisturbed vegetation communities.</li> <li>A weed management plan for the edges of all relocated vegetation, trails, roads and tracks is to be prepared to ensure that as weeds establish, they are removed annually to prevent further spread into the vegetation. Reporting on the spread and removal of weeds is to be provided annually to the Department of Conservation.</li> </ul>	Low

## 7 Conclusion and Recommendations

NZ Ski limited propose to expand the existing mountain bike trails within the Coronet Peak Recreation Reserve by approximately 10,933 linear metres. This will result in the maximum vegetation disturbance of approximately 16,915 m<sup>2</sup> with less being likely depending on the final width of the trails. Overall, the ecological impact associated with the construction of the trails is low provided the following recommendations are followed:

- 1) No disturbance of vegetation or terrain is to occur outside the proposed extents as mapped by Figure 2 and detailed in Table 1, unless otherwise specified.
- 2) Trail construction should be consistent with the New Zealand Mountain Bike Trail Design & Construction Guidelines (see Appendix A).
- 3) The dracophyllum shrubland – tussock grassland communities (dracophyllum-tussock shrubland, dracophyllum-tussock-celmisia shrubland and tussock – exotic grassland) are to be uplifted, stored upright and reinstated onto the newly contoured terrain, as soon as possible after the earthworks are complete. Plants stored shall not be more than one plant high.
- 4) The methodology for relocating vegetation within the cushionfield and from rocky outcrop communities is to be developed and approved by a suitably qualified ecologist and the Department of Conservation prior to any works commencing within these areas.
- 5) Modified vegetation that has a high number of exotic species should not be mixed with currently unmodified, weed free indigenous vegetation.
- 6) All *Brachyscome montana*, *Epilobium purpuratum* and *Myosotis elderi* are to be individually identified and either avoided or relocated prior to works commencing.
- 7) The relocation of Threatened, At Risk and data deficient species is to be completed using hand tools ensuring the plants are not damaged on removal and individually moved to suitable nearby habitat. Species are not to be stored or transferred to another vessel for transportation to preserve associated soils and root cohesion.
- 8) The relocated and reinstated areas of native plants are to be independently monitored for at least five years, to determine successful reinstatement and growth of all communities. Methodologies may include photo monitoring points, survival rate counts, transects or quadrats. Further mitigation measures are to be implemented if the cover and survival achieved is not sufficient to

achieve a no net loss. Reporting is to be provided annually to the Department of Conservation.

- 9) Works associated with earth moving or off-track travel must be completed outside the months of August – January to avoid nesting pipit. Where unavoidable disturbance is required within the breeding/nesting season the following alternative methods are required:
  - Authorisation under the Wildlife Act 1953 (administered by DOC) is to be sought to disturb indigenous species or;
  - A suitably qualified ecologist or ornithologist must undertake a survey of areas to be disturbed and all recommendation of the survey are to be implemented.
- 10) To minimise the potential for the spread of exotic weeds, no soil from outside the study area is to be brought onto the site, and no soil is to be moved upslope, particularly from the Lower Lift Station areas.
- 11) Prior to any machinery or equipment entering the study area it must be cleaned and checked for soil that could potentially contain seeds or exotic plants that could further contaminate the site. Excavator buckets and tracks are checked and cleaned prior to entering undisturbed vegetation communities.
- 12) Any machinery operators must have demonstrable experience in low impact earthworks and vegetation rehabilitation in an alpine environment.
- 13) A weed management plan for the edges of all relocated vegetation, trails, roads and tracks is to be prepared to ensure that as weeds establish, they are removed annually to prevent further spread into the vegetation. Reporting on the spread and removal of weeds is to be provided annually to the Department of Conservation.
- 14) Refuelling must be undertaken on hard surfaces away from native vegetation and waterways.
- 15) A site-specific sediment and erosion control management plan to mitigate the risk of runoff into wetlands, watercourses, and onto neighbouring vegetation is to be prepared and approved prior to works commencing. This management plan is to include a drainage plan, which will ensure that as the topography is altered, long term sediment runoff is managed to minimise potential damage from rainfall events.
- 16) No earthworks or vegetation removal is to occur in or within 10 m of any wetland. No alteration to the existing flow path, flow direction and the hydrological connection of any wetland is to occur.

- 17) All temporary and permanent bridge designs are to be approved by a suitably qualified hydrologist prior to construction, to ensure hydrological function and connectivity of all wetlands and waterways are preserved.
- 18) If any lizards are observed on site before or during earthworks, work shall cease, and advice be sought from the Department of Conservation regarding permission needed under the Wildlife Act to undertake work in lizard habitat.

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Appendices:



Appendix A: New Zealand Mountain Bike  
Trail Design & Construction Guidelines

# New Zealand Mountain Bike Trail Design & Construction Guidelines



Department of  
Conservation  
*Te Papa Atawhai*



Te Kaporeihana Āwhina Hunga Whara



THE NEW ZEALAND CYCLE TRAIL



SUPPORTING NZ BIKE TRAILS



Absolutely Positively  
**Wellington City Council**  
Me Heke Ki Pōneke



# New Zealand Mountain Bike Trail Design & Construction Guidelines

Mountain Biking has quickly become a mainstream sport, with a broad range of bike trails being developed all around New Zealand.

Projects are now being driven by land managers such as DOC, Iwi, local and regional councils and also private land owners, adding a more structured and professional approach to complement the well established volunteer based, club driven structure.

Often the project manager or engineer managing the project has no background in the sport, and the volunteer driver may be light on the steps needed to produce a fit for purpose product.

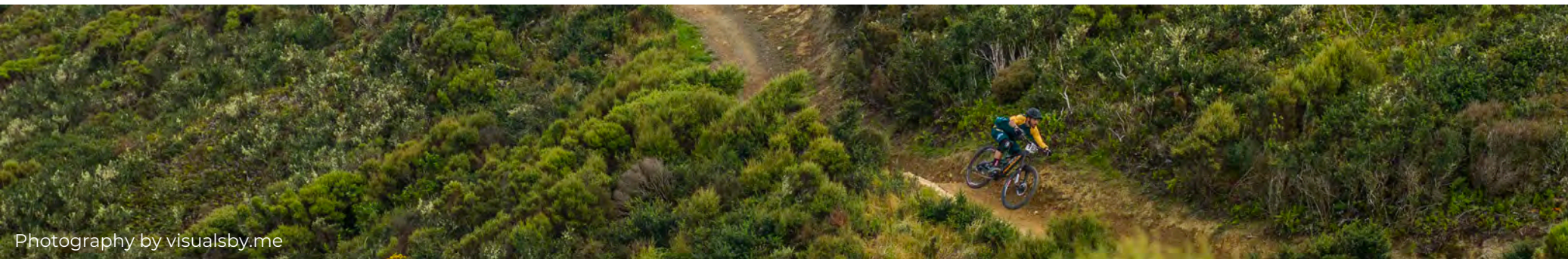
This new guideline is intended to help all parties develop and clarify their understanding of the creative elements that go into delivering a fun trail experience at each of the six different grades of difficulty.

This guideline gives a detailed and defined specification for new trails at each grade, and also provides a template for the maintenance and auditing of existing trails. Any organisation involved with developing, building, maintaining or auditing a trail is encouraged to use these guidelines - with the over riding goal for NZ being a level of consistency and continuity around trail grading to ensure a fantastic user experience



## Trail Specifications

Specification	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 Expert	Grade 6 Extreme
Target Audience	Suitable for all ages and most fitness levels. The trail feels safe to ride and is ideal as a first ride for non-cyclists, and those wanting an easy gradient or experience. They shall be well formed, flat, wide and smooth. The trail allows for cyclists to ride two abreast most of the time, and provides a social component to the ride. Cyclists will be able to ride the total distance of the trail without dismounting for obstacles.	Riders develop balance and gear choice skills. Trail shall be well formed, smooth and with some gentle climbs, is predictable with no surprises and is suitable for beginner riders. Trail has a social aspect with riders being able to ride side by side at times but the majority of the trail provides for a single rider. Suitable for most ages and fitness levels	Riders develop controlled braking skills, and gain riding experience. These trails can be narrow with some hills to climb. There may also be some exposure to drop-offs. Rider needs the skills to ride narrower tracks and maintain balance on a narrower surface, steer to avoid or ride over obstacles up to 100mm high or deep	Riders develop accurate line choice, controlling braking on the edge of traction, and gain further riding experience. Obstacles increase in size and frequency, track width varies. Some backcountry trails may also be 2-way at this grade.	Riders develop skills to control a bike in sections of trail where there is poor or no traction. Grade 5 trails are technically challenging with big hills, often lots of rocks and some walking likely. Grade 5 trails may traverse a wide range of terrain and cater for riders with generally high levels of skills and experience. Easier "B" Lines should be provided around un-rollable obstacles. Trails at this grade should be 1-way.	Riders develop supreme bike and tyre placement accuracy. Trail may not be passable in wet weather conditions. These trails include those purposely built downhill / free ride trails for technically advanced and highly experienced riders. Grade 6 trails may traverse a wide range of terrain with large jumps and obstacles catering for extreme riders, without easier "B" lines. Trails at this grade should be 1-way.
Sideslope <5°	Minimum Trail Tread Width 1-way or 2-way 1.5m	Minimum Trail Tread Width 1-way: 900mm, 2-way: 1.2m	Minimum Trail Tread Width 1-way: 600mm, 2-way: 1.2m	Minimum Trail Tread Width 300mm	Minimum Trail Tread Width 250mm	Minimum Trail Tread Width 100mm
Sideslope 5-15°	1-way or 2-way 1.5m	1-way: 900mm, 2-way: 1.2m	1-way: 800mm, 2-way: 1.2m	300mm	250mm	100mm
Sideslope 15-30°	1-way or 2-way 1.8m	1-way or 2-way 1.2m	1-way: 900mm, 2-way: 1.2m	400mm	250mm	100mm
Sideslope 30-45°	1-way or 2-way 2m	1-way or 2-way 1.2m	1-way or 2-way 1.2m	500mm	250mm	100mm
Sideslopes over 45°	1-way or 2-way 2.5m	1-way or 2-way 1.5m	1-way or 2-way 1.2m	600mm	250mm	100mm
2-way Width	Regular passing bays, and/or wider sections of trail should be incorporated to assist 2-way trail flow				1-way trails only	
Guidance	<ul style="list-style-type: none"> <li>As sideslope on the downhill side of the track increases, the consequence of fall increases, therefore the skill level required to ride the track safely increases. Allow extra width where side slopes are steepest.</li> <li>Grade reversals are recommended at intervals relative to the gradient and soil type of the trail; spacing between reversals should decrease as gradient increases (see table 1). A grade reversal should occur at every unbridged water crossing point.</li> <li>Tread outslope of 3-5° should be utilised where ever possible (except for insloped corners and where insloped water table drains are needed for boggy ground)</li> </ul>					



## Uphill Trails

Specification	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 Expert	Grade 6 Extreme
<b>UPHILL TRAILS</b>						
Target Average Gradient	2° (1 in 28.6) for no less than 98% of the trail.	3.5° ± 1° (1 in 16.3) for no less than 95% of the trail.	5° ± 1° (1 in 11.4) for no less than 90% of the trail.	6° ± 1° (1 in 10.5) for 90% of the trail.	10° (1 in 5.7) for 90% of the trail.	15° (1 in 3.7) for 90% of the trail.
(A) Steeper uphill gradients may occur up to 200m long.	Maximum of 3° (1 in 19.1)	Maximum of 5° (1 in 11.4)	Maximum of 7° (1 in 8.2)	Maximum of 9° (1 in 6.3)	Maximum of 13° (1 in 4.3)	Maximum of 16° (1 in 3.1)
(B) for slopes up to 10-20m long.	Maximum of 4° (1 in 14.3) for up to 10m	Maximum of 6° (1 in 10.5) for up to 10m	Maximum of 10° (1 in 6.3) for up to 10m	Maximum of 12° (1 in 5.1) for up to 15m	Maximum of 15° (1 in 3.7) for up to 15m	Maximum of 20° (1 in 2.7) for up to 20m
	A and B combined shall not exceed 2% of the track length	A, B and C combined shall not exceed 5% of the track length	A and B combined shall not exceed 10% of the track length.		A and B combined shall not exceed 20% of the track length	
Guidance						
<ul style="list-style-type: none"> <li>Any steep uphill sections of trail, are best to occur before or after a flat section or grade reversal. Not at the end of a long section at maximum gradient</li> <li>Trail average gradients of 5.7° (1 in 10) are most sustainable. Trail gradients steeper than this are physically unsustainable, will erode quickly and require a high level of armouring and maintenance to keep to grade.</li> <li>Maximum sustainable trail gradients may need to be less than stated based on a number of environmental factors (see table 2)</li> <li>Trail grade should be reasonably consistent. Where a section is out of grade, it should be no more than 1 grade harder than the target</li> </ul>						

## Descending Trails

Specification	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 Expert	Grade 6 Extreme
<b>DESCENDING TRAILS</b>						
Target Gradient (trail average)	3.5° (1 in 16.3)	5° (1 in 11.4)	6° (1 in 10.5)	10° (1 in 6.3)	14° (1 in 4)	No target
Maximum Gradient	4° (1 in 14.3)	8° (1 in 7)	11° (1 in 5.1)	15° (1 in 3.7)	20° (1 in 2.7)	There is no maximum downhill gradient
Technical Trail Features (jumps, drops, etc)	All features roll-able, no stepped drops	All features roll-able Stepped drops maximum height of 200mm with gentle downhill transitions, and wide "B" lines	All features roll-able. Gap jumps max length 2m Stepped drops max height of 600mm with gentle downhill transitions. Jump ramp angle max 35°	Features mostly roll-able. Gap jumps not rollable must have clearly identified "B" lines. Stepped drops max height of 1m Jump ramp angle max 45°	Features mostly roll-able. Gap jumps not rollable must have clearly identified "B" lines. Stepped drops max height of 1.5m Jump ramp angle max 45°	Trail style will determine type of features. No "B" lines required, but are recommended
Guidance						
<ul style="list-style-type: none"> <li>Utilise a reverse gradient approach up and over a ridge before turning, rather than turning on a ridge (creating a blind corner)</li> <li>Trail average gradients of 5.7° (1 in 10) are most sustainable. Trail gradients steeper than this are physically unsustainable, will erode quickly and require a high level of armouring and maintenance to keep to grade.</li> <li>Maximum sustainable trail gradients may need to be less than stated based on a number of environmental factors (see table 2)</li> </ul>						

## General Guidance

Specification	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 Expert	Grade 6 Extreme
<b>GENERAL</b>						
Mud	None	Trails can have up to 2% wet and muddy sections. These shall be no deeper than 50mm and should be rideable. To ensure that wet or muddy sections of trail are not excessively long, they should constitute no more than 1m in every 50m			Trails can have up to 2m of mud in every 50m, up to 300mm deep. Riders should typically expect to dismount for these muddy sections.	
Tread Obstacles	None	Up to 50mm	Up to 100mm high	Up to 1m high with bypass	No limit, with bypass	No limit, no bypass
Turn Radius to outside of tread	6m ± 1m	Minimum 4m, 5m minimum desirable	Minimum 2.5m, desirable minimum 3m or more if it is a fast trail.	Minimum 2m, desirable minimum 3m, more if speed is fast section of trail.	Minimum 1.5m, more if speed is desired.	Minimum 1m, more if speed is desired.
Maximum Corner Camber (table 3)	+10deg - 2 degrees Blending to flat inside radius	+ 20 deg – 3 deg Blending to flat inside radius	+40 deg – 3 deg Blending to flat inside radius	No camber restrictions		
Clearances to	<i>Vegetation, Large rocks, Bridge abutments, Sculptures, Power and light poles, Sign posts and perpendicular drains:</i> All shall be cleared a minimum of 0.15m and a maximum of 0.3m from the outer edge of the trail formation and to a height of 2.4m, giving riders a clear passage and an unimpeded view of the surface. Additional clearance of up to 800mm is necessary on bends where riders will lean into corners. 2.0 – 2.4m height clearance may be allowable in some circumstances (ie, bridge abutments, valuable trees, etc).					
Clearances to	<i>Fences, walls, bridge handrails, guard rails, steep slopes, banks and batters, rock faces, parallel drains, lakes, rivers, coastlines, hedges and buildings:</i> All shall be cleared a to minimum of 0.5m and a maximum of 1.0m from the outer edge of the Trail formation and to a height of 2.4 m, giving riders a clear passage and an unimpeded view of the surface.					
Cut / cleared Vegetation Treatment Options	Trees and shrubs should be assessed for their ecological value, and where possible, exotic species removed rather than native species. Trail alignment should be adjusted to avoid removing rare and/or large native trees which are valuable to the landscape and ecological values of the trail.					
	All limbs should be cut flush (or to within 10mm) of the trunk or main branch or ground.					
	All cut woody vegetation shall be removed from the track surface and vegetation <100mm Chipped, vegetation >100mm moved out of site of the track. Note this option is only likely to be suitable for high value scenic reserves, National Parks etc					
	All cut woody vegetation shall be removed from the track surface and, if practicable, out of view of the track, this option is typical for DOC and Council reserves					
Additional Clearances	All cut woody vegetation shall be removed from the track surface and placed beside track to biodegrade, does not have to be out of sight, this option is typical for Forestry Plantations					
Additional Clearances	On shared use or 2-way trails, vegetation clearance, especially on corners, shall be sufficient to allow good visibility to a recommended 10m minimum sight distance for cyclists and walkers. Where riding speed is likely to be over 20kph, increase the sight distance to 20m if possible.					
Trail Surface	The surface of the trail shall be well formed, smooth and even and shall be made of durable material, such as concrete, chip seal or asphalt, or compacted top aggregate of <b>20mm</b> . Wet areas shall be drained. In dry weather the trail surface shall be such that it can be ridden on comfortably without getting wet or muddy	The surface of the trail shall be well formed, smooth and durable. Surface material maybe compacted <b>30mm</b> aggregate. Wet areas shall be drained. In dry weather the trail surface shall be such that it can be rode on comfortably without getting wet or muddy.  Some rocks, roots, ruts that can either be avoided, or are less than 50mm high.	The surface of the trail shall be mostly well formed, even and generally firm. Trails may have some loose sections where the trail surface is broken by rock, roots, scree or other obstacles. These sections shall still provide reasonably good riding conditions in all weather. Wet areas shall be drained. In dry weather the trail surface shall be such that it can be rode on comfortably without getting wet or muddy.	The surface of the trail shall be generally firm but may have some loose sections where the trail surface is broken by rock, roots, scree or other obstacles these shall be no higher/deeper than 200mm. These sections should still provide reasonably good riding conditions in all weather.  Wet areas shall be drained. In dry weather the trail surface shall be such that it can be rode on comfortably without getting wet or muddy.	The trail surface will be highly variable and shall generally be the natural surface and may include mud, water, roots, ruts and embedded rocks. Major obstacles such as windfalls are to be removed or the track diverted around them. Generally minor obstacles such as rocks, tree roots and earth are not to be removed.  The surface of the trail <b>may be</b> firm, loose and have muddy sections. There will be steep climbs with unavoidable obstacles on a narrow trail. Many roots and ruts up to 0.6 m high or deep. The trail surface shall be mostly well formed and even with wet areas drained  Up to 50% of the total length of track may have:  (a) short wet or muddy sections or (b) uneven or rough sections where the trail surface is broken by rock, roots, scree or other obstacles. These sections must still provide reasonably good riding conditions in all weather.	

## General Guidance

Specification	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 Expert	Grade 6 Extreme
Environmental Consideration	<ul style="list-style-type: none"> <li>Check local council rules, building consent requirements etc, any local planning restrictions/constraints and Resource Management Act requirements before design and construction</li> <li>Earthworks machinery, hand tools and PPE should be cleaned before being brought on to site to avoid importing weeds</li> <li>In native forests, and close to waterways, extra care needs to be taken to avoid soil erosion and sediment entering streams. Close to waterways, sustainable trail construction involves compacting dug soil on the side of the track so that it doesn't wash to streams. Berms and trail gradients will be more gentle, to avoid soil erosion</li> <li>Plant grass or native vegetation alongside the edge of the track as soon as possible after construction, so as to stabilise the edges and reduce visual impact. This may involve replanting plants that have been dug from the trail alignment during construction.</li> <li>Imported gravel, soil and armouring materials must be from any weed-free source.</li> <li>Survey tags, left over construction materials/signs, spray painted marks and general rubbish should be removed at trail completion.</li> <li>A formal safety audit should be completed at trail completion, including assessing the safety of potential fall zones</li> </ul>					
The minimum structure width shall be	1.2m with handrails/barrier to fall or 1.5m for boardwalks without handrails/barrier to fall. The approach to the structure for at least 10m should be the same width as the structure	1.2m. The approach to the structure for at least 10m should be the same width as the structure	0.9m with handrails /barrier to fall and 1.2m without.	0.6m	0.4m	0.2m
Boardwalks (no handrails or barrier to fall) Width depends on the length, and the height of fall. Measurement not including kickboards.	The minimum boardwalk width shall be 1.5m. Boardwalks shall be used over wet, swampy, sandy or muddy sections to achieve a stable dry surface for visitor comfort and/or to protect the environment.	The minimum boardwalk width shall be 1.2m. Boardwalks may be used over wet, swampy, sandy or muddy sections of the trail to achieve a mainly dry surface and/or protect the environment. Alternatives to boardwalks, such as drainage of wet areas or raised, hardened sections of track, may also be used	The minimum boardwalk width shall be 0.9m. The approach to the structure for at least 10m should be the same width as the structure	The minimum boardwalk width shall be 0.6m. The approach to the structure for at least 10m should be the same width as the structure	Boardwalks are not generally provided on grade 5 trails. Instead where muddy, sandy or swampy conditions exist tracks are to be drained, rerouted or raised. If there is no alternative, boardwalks may be constructed only where they are necessary to mitigate significant environmental effects. Minimum 0.4m for Grade 5, 0.2m for Grade 6	
Bridges (Flared handrails or barrier to fall required to provide handlebar clearance)	All major watercourses shall be bridged. Minor watercourses should also be bridged, except where culverting may be more appropriate.	Watercourses with less than 100mm of water in normal flow and can be easily ridden shall not have bridges; all other watercourses shall be bridged. Culverts may be utilised where appropriate.	All major and minor watercourses shall be bridged except fords with less than 200mm of water in normal flow. The minimum bridge width shall be 0.9m. The approach to the structure for at least 10m should be the same width as the structure. Culverts may be utilised where appropriate	All major and minor watercourses shall be bridged except fords with less than 300mm of water in normal flow. The minimum bridge width shall be 0.6m. The approach to the structure for at least 10m should be the same width as the structure Culverts may be utilised where appropriate	Water courses shall be bridged where they cannot be safely crossed without the help of others during times of normal water flow. Watercourses shall also be bridged where: (a) No reasonable alternative wet weather track exists; and (b) They cannot be safely crossed unassisted when in flood; and (c)Floods occur with a frequency that means the water course is a barrier to progress or becomes a significant hazard and (d)There is no accommodation/shelter within 2 hours riding distance where visitors can wait until the river/stream conditions improve	

## General Guidance

Specification	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 Expert	Grade 6 Extreme
Guardrails / barriers	Where a significant hazard (such as bluffs) exists and there is no other alternative, a barrier or guardrail shall be provided. Barriers and guardrails shall extend for the full length along which the significant hazard exists.					
Viewing platforms	Viewing platforms may be provided in appropriate places along the trail.			Viewing platforms <b>shall not</b> generally be provided on these trails.		
Steps	No 'Walking' Steps, No Stiles		'Walking' Steps are undesirable, however may be used as long as less than 1% of track length			
Shelters & Toilets	Shelters may be provided where there is a significant level of exposure to adverse weather conditions on the most distant parts of the trail. Where shelters are provided, toilets should also be provided at those locations that are popular stops. Toilets should ideally be provided at an interval of not less than 15 km and not greater than 20km apart.					
Furniture	Seats and picnic tables may be provided.			Seats and picnic tables are not generally provided on these trails.		
Signage	Ideally include riding times, distances and grid references at entrances, exits and at all junctions. Significant points of interest along or at the end of the trail should be signposted. At locations where there is a jump to a higher grade, signs shall be provided with appropriate symbols and words to describe the change. An orientation/track information sign should be provided at entrances where more than one riding option exists.					
Trail Type	It's helpful for trail signage to show the trail type: "Technical" typically mean slow speed, rough rooty/rocky surface. "Flow" typically means high speed, smooth surface jumps, rollers and berms.					
Shared Use Trail Signage	The trail shall be clearly labeled as one suitable for pedestrians and cyclists by use of appropriate symbols at track entrances and junctions. At junctions where the trails change from dual use to only walking or off-road cycling there shall be appropriate symbols to inform the user					
Guidance	One of the most difficult sections of trail should be at the start, to act as a 'gateway' or 'filter' that deters riders with not enough skill. Difficult sections should be no more than one grade harder than the overall trail grade. The safest tracks are 'grade consistent'.					





## Guideline for the Provision of Barriers beside Tracks and Structures (based on SNZ HB 8630:2004)

Measure Fall Height Hf 1.5m out from edge of track, or structure that is <1.5m high, for structures that are between 1.5 and 2m high measure Fall Height at the same distance out from the structure as it is high, For Structures >2m high, measure Fall Height 2m out from the structure edge.	Grade 1 Easiest	Grade 2 Easy	Grade 3 Intermediate	Grade 4 Advanced	Grade 5 & 6 Expert & Extreme
Fall onto a benign surface presenting features that will tend to reduce the effect of impact (a) Deep moss (b) Soft vegetation (c) Shallow still water deep enough to cushion a fall (d) Swamp	Hf > 2.0m Provide Type A Barrier Hf = 1.0-2.0m Provide Type B barrier Hf < 1.0m no barrier	Hf > 3.5m Provide Type A Barrier Hf = 2.0-3.5m Provide Type B barrier Hf < 2.0m no barrier	Hf > 2.0m Provide Type B Barrier Hf < 2.0m no barrier	Hf > 2.5m Provide Type C Barrier Hf < 2.5m no barrier	Hf > 3.5m Provide Type C Barrier Hf < 3.5m no barrier
Favourable surface presenting features that neither reduce nor amplify the effect of impact (a) Gravel (b) Sand (c) Deep water with reasonable means of exit (d) Grass	Hf > 1.5m Provide Type A Barrier Hf = 0.5-1.5m Provide Type B barrier Hf < 0.5m no barrier	Hf > 3.0m Provide Type A Barrier Hf = 1.5-3.0m Provide Type B barrier Hf < 1.5m no barrier	Hf > 1.5m Provide Type B Barrier Hf < 1.5m no barrier	Hf > 2.0m Provide Type C Barrier Hf < 2.0m no barrier	Hf > 3.0m Provide Type C Barrier Hf < 3.0m no barrier
Unfavourable surface presenting features that will tend to amplify the effect of impact (a) Jagged stones (b) Concrete pavement (c) Deep water without reasonable means of exit (d) Sharp vegetation	Hf > 1.0m Provide Type A Barrier Hf < 1m Provide Type B Barrier	Hf > 2.5m Provide Type A Barrier Hf = 1.0-2.5m Provide Type B barrier Hf < 1m no barrier	Hf > 1.0m Provide Type B Barrier Hf < 1.0m no barrier	Hf > 1.5m Provide Type C Barrier Hf < 1.5m no barrier	Hf > 2.5m Provide Type C Barrier Hf < 2.5m no barrier
Hazardous surface presenting features that will result in serious harm, regardless of the effect of fall to the initial impact point (a) Swiftly flowing water without means of exit (b) Boiling mud or water (c) Extended falls arising from rolling or sliding, following initial impact, on terrain whose slope exceeds 35deg. Mitigating factors such as vegetation likely to arrest rolling shall be taken into account when assessing extended falls	Provide Type A Barrier	Provide Type A Barrier	Provide Type B Barrier	Provide Type C Barrier	Provide Type C Barrier

**Note 1:** The above table is derived from SNZ HB 8630:2004 and assumes that the walking user groups identified translate to the MTB trail grades 1-6.

**Note 2:** For tracks and structures with tread width <1.2m it's recommended that barriers be angled outwards at approx. 5 deg from vertical to allow clearance for handlebars

**Note 3:** For structures <1.5m in height and not requiring building consent, the following linked references provide ideal construction information and templates: [WCC Description](#) and [Frame Group Drawings](#)

### Barrier construction

#### 1. Type A Barriers

If openings are present, they shall be small enough to prevent a sphere of 100 mm diameter or greater passing through. Barrier components that are between 150 mm and 760 mm above the deck (or stair nosing) shall be constructed to prevent toeholds from being obtained. The triangular opening formed by the riser, tread and bottom rail at the open side of a stairway shall be constructed so that passage by a 150 mm diameter sphere is prevented.

#### 2. Type B Barrier

Openings in type B barriers shall have maximum dimensions of either:

- (a) 200 mm horizontally between vertical balusters, or
- (b) 300 mm vertically (between intermediate rails) with any openings less than 150 mm between the deck and first horizontal rail.

#### 3. Type C Barrier

Any openings in type C barriers shall have a maximum dimension of 500 mm vertically (between intermediate rails). There is no maximum dimension between vertical sections.

**Table 1 Grade Reversal (Tread Length Management)** Ref: Natural Surface Trails by Design, Troy Scott Parker, 2004

Substrate	Tread Grade										
	0°	1.1°	2.3°	3.4°	4.6°	5.7°	6.8°	8°	9.1°	10.2°	11.3°
Clay loam with high quantity of gravels, stones	65m	49m	37m	27m	20m	15m	11m	7m	5m	2m	2m
Gravelly clay	55m	40m	29m	21m	15m	10m	7m	4m	2.5m	1m	
Loam with high quantity of gravels, stones	49m	36m	25m	17m	12m	8m	5m	3m	2m	1m	
Clay	44m	32m	23m	16m	10m	7m	4m	2m	1m		
Loam	41m	27m	17m	11m	7m	4m	2m	1m			
Crushed granite or limestone, with angular particles 20mm, 125mm thick	38m	24m	15m	9m	5m	3m	1m				
Organic soil	34m	21m	12m	7m	4m	2m					
Sand	30m	17m	9m	5m	2m	1m					

**Notes:**

1. Tread length stated is the distance between a tread crest and the adjacent dip.
2. These values are designed to minimize tread maintenance and minimize tread shape change through erosion
3. Values reflect high splash erosion (no tree canopy)
4. Assumes severe rainfall events of 1-3 times per year. Higher rainfall areas should use shorter tread watershed distances.
5. No tread should have a 0° grade – this column reflects tread grades between 0 and 2°
6. Compacted pure clay while cohesive even on steep grades when dry, is generally too slippery when wet to be practical.

**Guidance Notes:**

- Grade reversals should be placed at all unbridged water crossings, and at all points where water will flow in heavy rain.
- Grade reversals are also useful for slowing riders down before switchbacks and track junctions.



Photography by visualsby.me

**Table 2 Factors Influencing Maximum Sustainable Trail Gradient**

<b>Half Rule</b>	Gradient should not exceed half the grade of the sideslope – if it does, it is considered fall-line.
<b>Soil Type</b>	Some soils will support steeper grades than others – knowing the cohesion and drainage properties of the soil is important
<b>Rock</b>	Solid rock trails will support steeper grades.
<b>Annual Rainfall</b>	Very high and very low rainfall areas may need to be designed with gentler grades
<b>Grade Reversals</b>	Frequent grade reversals will allow for slightly steeper grades
<b>Type of Users</b>	Walkers and Mountain bikers are generally low impact users. If high impact users share the trail, more gentle grades should be considered
<b>Number of Users</b>	High use trails may need more gentle grades
<b>Difficulty Level</b>	Grade 4-6 trails with a desired higher difficulty level may be steeper, but techniques such as frequent grade reversal and tread armouring may be essential to ensure sustainability

## Table 3 Ideal Camber Angles for Berm Style Corners

Speed into Corner km/hr	2m turn radius	3m turn radius	4m turn radius	5m turn radius	6m turn radius
	degrees				
5	11	6	4	3	2
10	21	15	11	9	7
15	42	31	24	19	16
20	58	46	38	32	28
25	68	59	51	45	39
30	74	67	61	55	50
35	78	73	67	63	58
40	81	77	72	68	65
45	83	79	76	73	69

### Key

Grade 1 <20 degrees maximum
Grade 2 <35 degrees maximum
Grade 3 <58 degrees maximum
Grade 4 <70 degrees maximum
Grade 5 <80 degrees maximum

### Notes:

- Human powered bike climbing speeds (on singletrack) are typically 5-10km/hr
- E-bike (<300W) climbing speeds (on singletrack) are typically 10-15km/hr
- Descending speeds vary but typically speed increases with grade
- Designers need to make an assessment or trail speed into a corner to determine berm/camber/radius requirements

### Guidance Notes:

- Select locations for turns where there is room for a reasonable turn radius while minimizing the requirement for excavation and retaining walls
- Trail gradient through the turn should match the overall trail gradient, as shown in the following table:

Turn Radius (m)	Average Trail Gradient (degrees)				
	3.5	5	6	10	14
	Trail Drop (m) – entry to exit for 180 degree turn, measured at centre of ride line				
2	0.4	0.5	0.7	1.1	1.5
3	0.6	0.8	1.0	1.6	2.3
4	0.8	1.1	1.3	2.2	3.0
5	1.0	1.4	1.6	2.7	3.8
6	1.2	1.6	2.0	3.3	4.6

### Key

Grade 1
Grade 2
Grade 3
Grade 4
Grade 5



July 2018 Final Draft - Origin

Document Authors: Jeff Carter, Jonathan Kennett, Chris Mildon

Contributing Organisations: Southstar Trails; Nga Haerenga NZ Cycle Trail; MTB Trails Trust; Tasman Trails; Wellington City Council; Department of Conservation (Steven Peters); Trail Fund NZ; MTB Skills Clinics.

Appendix B: Ecological assessment of  
vegetation communities using the  
ecological criteria in the EcIA Guidelines  
and QLDC significance criteria.

Dracophyllum - Tussock Shrubland			
Matter	Rationale	EclA Score <sup>i</sup>	QLDC Criteria
Representativeness	The vegetation is typical of the structure and composition of native cover found and similar altitudes in the Shotover Ecological District. Ski trails and previous disturbance have caused fragmentation of the community across the site and exotic weeds/pasture species are present within areas adjacent ski trails and infrastructure.	Moderate	Yes
Rarity	The vegetation community is not considered to be an uncommon ecosystem and this area does not contain any threatened or at-risk species. The associated areas are located within a Land Environment where there is > 30% indigenous cover left and > 20% protected.	Low/Moderate <sup>ii</sup>	No
Distinctiveness	The vegetation community does not contain species at their distributional limit or that have developed due to unique environmental factors.	Low	No
Diversity and Pattern	The vegetation community contains a high level of natural diversity. However exotic species are present within the areas fringing tracks and open habitat. The distribution of the vegetation across the landscape reflects the natural underlying physical patterns. Species and community composition change in response to aspect, exposure to wind, sun and soil depth.	High	Yes
Ecological Context	The habitat is part of a continuous tract of indigenous vegetation and is largely continuous within the surrounding mountains. However, disturbance and fragmentation is noted. The indigenous vegetation is an important buffer of the surrounding landscape, including naturally rare communities. The area provides important breeding and foraging habitat for a range of At-risk and Threatened indigenous fauna.	Very High	Yes

<sup>i</sup>Rarity and distinctiveness have separated out to align with the QLDC criteria and would otherwise be assessed as one matter. As such, the two matters have been considered as one when determining the overall ecological value under the EIANZ guidelines.

<sup>ii</sup> Moderate in areas where *Brachyscome montana* is present.

Overall EIANZ Ecological Value Score and QLDC Significance Criteria		Very High	Yes
Dracophyllum -Tussock – Celmisia Shrubland			
Matter	Rationale	EclA Score <sup>iii</sup>	QLDC Criteria
Representativeness	The vegetation is typical of the structure and composition of native cover found and similar altitudes in the Shotover Ecological District. Current and historic disturbance has caused fragmentation of the community across the site and a shift in the fundamental vegetation composition.	Moderate	Yes
Rarity	The vegetation community is not considered to be an uncommon ecosystem and this area does not contain any threatened or at-risk species. The associated areas are located within a Land Environment where there is > 30% indigenous cover left and > 20% protected.	Low	No
Distinctiveness	The vegetation community does not contain species at their distributional limit or that have developed as a result of unique environmental factors.	Low	No
Diversity and Pattern	This community is dominated by indigenous species and supports a moderate degree of indigenous diversity. However, missing key compositional components and is notably less diverse than adjoining habitats as a result of higher organic litter.	Moderate	No
Ecological Context	The vegetation community is surrounded by large ski trails/roads and is highly fragmented in comparison to other vegetation communities. The areas provide a limited degree of disbursement function to the adjacent habitats. However, could potentially support habitat for the At Risk, Southern grass skink as well as some foraging habitat for a range of At Risk and/or Threatened avifauna.	Moderate	Yes
Overall EIANZ Ecological Value Score and QLDC Significance Criteria		Moderate	Yes

<sup>iii</sup>Rarity and distinctiveness have separated out to align with the QLDC criteria and would otherwise be assessed as one matter. As such, the two matters have been considered as one when determining the overall ecological value under the EIANZ guidelines.

Rocky Outcrop			
Matter	Rationale	EclA Score <sup>iv</sup>	QLDC Criteria
Representativeness	Whilst not extensive, this community is typical of rocky, high-altitude vegetation in the ecological district. Species assemblages are predominantly indigenous.	High	Yes
Rarity	These habitats are naturally uncommon and distinctive locally, with a diverse range of indigenous species. The study area is within a Land Environment where there is > 30% indigenous cover left and > 20% protected. However, the At-Risk <i>Epilobium purpuratum</i> and the data deficient <i>Brachyscome montana</i> are present throughout the community.	Moderate	Yes
Distinctiveness	The vegetation community does not contain species at their distributional limit. However, species composition has developed as result of shallow topsoils and extreme light exposures or deficiencies on steep aspects.	Moderate	Yes
Diversity and Pattern	This community has a naturally high level of diversity, pattern and complexity. The opportunity for ecological gradients and complexity are only limited by the small extent of the community.	High	No
Ecological Context	The Community does not provide a significant connective, dispersal, or buffering function. However, may support some of At Risk and Threatened fauna species, amongst a contiguous indigenous ecosystem.	Moderate	Yes
Overall EIANZ Ecological Value Score and QLDC Significance Criteria		High	Yes

<sup>iv</sup>Rarity and distinctiveness have separated out to align with the QLDC criteria and would otherwise be assessed as one matter. As such, the two matters have been considered as one when determining the overall ecological value under the EIANZ guidelines.

Cushionfield			
Matter	Rationale	EclA Score <sup>v</sup>	QLDC Criteria
Representativeness	This habitat has the structure and composition typical of the local alpine environment. These areas of cushionfield have had minimal historic disturbance and are dominated by indigenous species and represent intact examples of the community in the ecological district.	Very High	Yes
Rarity	The cushionfields are not considered to be an uncommon ecosystem and this area does not contain any threatened or at-risk species. The associated areas are located within a Land Environment where there is > 30% indigenous cover left and > 20% protected. However, the data deficient <i>Bracyscome montana</i> is present in high densities throughout the community.	Moderate	Yes
Distinctiveness	The vegetation community does not contain species at their distributional limit. However, the communities have developed in response to shallow topsoil and low water availability being present on protruding ridgelines and spurs.	Moderate	Yes
Diversity and Pattern	The level of natural diversity within this community is high as all species expected to be present were found. The areas of cushionfield form a mosaic with the surrounding shrub and tussockland.	High	Yes
Ecological Context	The areas do not provide any buffering function. However, the areas of cushionfield form mosaic-like linkages with the surrounding shrub and tussocklands, contributing considerably to the ecological connection and dispersal of species across the site. The current fragmentation due to disturbance indicates they are of a size and condition that is sensitive to change. The areas are likely to provide foraging habitat for a range of At Risk and Threatened fauna species.	High	Yes

<sup>v</sup>Rarity and distinctiveness have separated out to align with the QLDC criteria and would otherwise be assessed as one matter. As such, the two matters have been considered as one when determining the overall ecological value under the EIANZ guidelines.



Overall EIANZ Ecological Value Score and QLDC Significance Criteria		Very High	Yes
Wetlands			
Matter	Rationale	EclA Score <sup>vi</sup>	QLDC Criteria
Representativeness	Most wetland communities present are typical of the alpine habitat within the ecological district. The community contains many of the species expected to be present. However, the wetlands at elevations below the ski field are more modified and have an exotic dominant vegetation coverage.	Very High / Low <sup>vii</sup>	Yes/No
Rarity	Ninety percent of all of pre-human wetlands within New Zealand wetlands have been lost. Although all apart from tarns are not consider originally rare ecosystems wetlands are now considered nationally rare following historic disturbance.	High	Yes
Distinctiveness	The wetlands have developed as a result of unique climatic and altitudinal factors and are reflective of their receiving environment. The wetland community does not contain species at their distributional limit, are endemic to Otago or are nationally threatened.	High	Yes
Diversity and Pattern	The level of natural diversity of wetlands within the ski field is very high supporting a range of compositionally different wetland types. Species typical of alpine wetlands are present and connect with the surrounding shrub and grassland communities. Areas below the ski field trail the diversity is limited and of predominantly exotic composition.	Very High / Low <sup>vii</sup>	Yes/No
Ecological Context	The wetlands provide important connectivity to neighbouring communities and forms an important buffer in water runoff protecting adjacent and downstream environments from increased water accumulation, sedimentation and/or erosion.	Very High	Yes

<sup>vi</sup>Rarity and distinctiveness have separated out to align with the QLDC criteria and would otherwise be assessed as one matter. As such, the two matters have been considered as one when determining the overall ecological value under the EIANZ guidelines.

<sup>vii</sup>Lower rating in locations below the ski field that are dominated by exotic species and subsequently do not satisfy the significance criteria for this assessment matter. Higher value applies at locations within the skifield.

Overall EIANZ Ecological Value Score and QLDC Significance Criteria	Very High / High <sup>vii</sup>	Yes
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Tussock – Exotic Grassland (Transitional Zone)			
Matter	Rationale	EcIA Score <sup>viii</sup>	QLDC Criteria
Representativeness	The vegetation is typical of the structure and composition of native cover found and similar altitudes in the Shotover Ecological District. Current and historic disturbance has caused fragmentation of the community across the site and a shift in the fundamental vegetation composition.	Moderate	Yes
Rarity	The vegetation community is not considered to be an uncommon ecosystem and this area does not contain any threatened or at-risk species. The associated areas are located within a Land Environment where there is > 30% indigenous cover left and > 20% protected	Low	No
Distinctiveness	The vegetation community does not contain species at their distributional limit or that have developed as a result of unique environmental factors.	Low	No
Diversity and Pattern	The vegetation community contains a high level of natural diversity, containing additional species that that observed in the Dracophyllum- tussock community. However, exotic species are present throughout the community and in areas are dominated by exotic grasses. The distribution of the vegetation across the landscape reflects the natural underlying physical patterns. Species and community composition change along the altitudinal gradient, as well as being shaped by exposure to wind, sun and soil depth.	Moderate	Yes

<sup>viii</sup>Rarity and distinctiveness have separated out to align with the QLDC criteria and would otherwise be assessed as one matter. As such, the two matters have been considered as one when determining the overall ecological value under the EIANZ guidelines.

Ecological Context	The habitat is part of a continuous tract of semi-indigenous vegetation within the surrounding mountains. The vegetation is an important buffer of the upgradient landscape, from more extensive exotic coverage at the lower extent of the CPRR. The area may provide breeding and foraging habitat for a range of At-risk and Threatened indigenous fauna.	Moderate	Yes
Overall EIANZ Ecological Value Score and QLDC Significance Criteria		Moderate	Yes
Disturbed Vegetation			
Matter	Rationale	EclA Score <sup>ix</sup>	QLDC Criteria
Representativeness	The majority of disturbed vegetation does not contain habitat that is representative of the natural cover of the ecological district. The vegetation cover is mostly, though not exclusively, exotic species. Where native vegetation prevails, they are scattered and of early successional species.	Low	No
Rarity	The majority of the vegetation within this community contained no At Risk or Threatened flora was seen in the disturbed areas. However, one location in 2018 recorded the Threatened – Nationally Vulnerable <i>Myosotis elderi</i> . The associated areas are located within a Land Environment where there is > 30% indigenous cover left and > 20% protected.	Low / Very High <sup>x</sup>	No/Yes
Distinctiveness	The vegetation community does not contain species at their distributional limit or that have developed as a result of unique environmental factors.	Low	No
Diversity and Pattern	The disturbed habitat includes places where indigenous vegetation is regenerating. In places native vegetation cover is greater than exotic cover, though this is scattered. Exotic vegetation is generally dominant and landform is highly modified.	Low	No

<sup>ix</sup>Rarity and distinctiveness have separated out to align with the QLDC criteria and would otherwise be assessed as one matter. As such, the two matters have been considered as one when determining the overall ecological value under the EIANZ guidelines.

<sup>x</sup> Ecological Value is Very High only in locations where *Myosotis elderii* is present. Where this occurs, the overall ecological value is Moderate and the significance criteria is met.

Ecological Context	The Community does not provide a significant connective, dispersal or buffering function. The areas have fragmented indigenous ecosystems and contribute grassy and herbaceous weeds which are spreading into surrounding areas.	Low	No
Overall EIANZ Ecological Value Score and QLDC Significance Criteria		Low/Moderate <sup>x</sup>	No / Yes <sup>x</sup>

