**REPORT**

# Mt Buller Summit Trail

*Geotechnical Assessment and Investigation*



Submitted to:

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# Distribution List

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# Table of Contents


**1.0 ENGAGEMENT** .... **1**

**2.0 BACKGROUND** .... **1**

2.1 Project location .... 1

2.2 Proposed development .... 1

**3.0 AIMS OF THE ASSESSMENT** .... **3**

**4.0 METHODOLOGY** .... **3**

4.1 Information reviewed .... 3

4.2 Site walkover .... 4

**5.0 RESULTS OF THE DESKTOP STUDY AND FIELD ASSESSMENT** .... **4**

5.1 Geology and Subsurface Materials .... 4

5.1.1 Geology .... 4

5.1.2 Geomorphology and Landslides .... 5

5.1.3 Founding conditions at proposed viewing platforms .... 7

5.1.3.1 Mt Buller summit viewing platform .... 7

5.1.3.2 McLaughlin's Shoulder viewing platform .... 8

**6.0 RECOMMENDATIONS** .... **9**

6.1 Foundations .... 9

6.2 Earthquake .... 11

**7.0 GEOTECHNICAL ASSESSMENT** .... **11**

7.1 Geotechnical hazard identification .... 11

7.2 Risk assessment .... 12

7.2.1 Scenario 1 (static case) .... 13

7.2.2 Scenario 2 (mobile case) .... 15

7.2.3 Outcome of assessment .... 17

**8.0 IMPORTANT INFORMATION** .... **17**

**9.0 REFERENCES** .... **18**

**FIGURES**

Figure 1: Location of site (image from Nearmap) ... 1

Figure 2: Proposed development (provided by RMB) ... 2

Figure 3: Extract from geological map around Mount Buller (1:50,000 Scale Victorian Seamless Geology, 2014) ... 4

Figure 4: LiDAR imagery with slopeshade (steeper slopes in red, less steep in blue) in the proposed trail area ... 5

Figure 5: Looking west along the proposed trail route between the Summit car park and the lower observation point ... 6

Figure 6: Outcrop above proposed trail with numerous loose blocks ... 6

Figure 7: Rock outcrop on the north side of Mount Buller summit ... 7

Figure 8: Sketch of the proposed Summit viewing platform founding conditions ... 8

Figure 9: Proposed McLaughlin's Shoulder viewing platform location ... 9

Figure 10: Potential rock fall runout zones in orange (extract from Golder, 2020) ... 12

Figure 11: F-N plot for Situation 1 ... 15

Figure 12: F-N plot for Situation 2 ... 17

**APPENDICES**

**APPENDIX A**
Important information relating to this report

# 1.0 ENGAGEMENT

The Mt Buller Mt Stirling Resort Management Board (RMB) has engaged Golder Associates Pty Ltd (Golder) to undertake a preliminary geotechnical risk assessment and investigation for proposed walking trails and associated lookouts at the summit of Mount Buller in Victoria. The proposed location of the works falls within the area covered by the Erosion Management Overlay (EMO) of the Alpine Resorts Planning Scheme. RMB requires an assessment to identify the geotechnical issues and hazards associated with the proposal, the impact these might have on the design and engineering of the proposed structures, and if applicable, to recommend means of further investigation and mitigation of the geotechnical issues identified. There is also a requirement to gather geotechnical information to inform foundation design for the proposed structures.

This report presents the results and findings of our assessment, which was performed in general accordance with the scope of services presented in our proposal (ref: CX21493847-001-P-Rev1) dated 1 September 2021. Approval to proceed with the assessment was provided by RMB via email (Argentov / Stretton) dated 9 September 2021.



# 2.0 BACKGROUND

## 2.1 Project location

The project site is located at and around the summit of Mount Buller. This location is subject to Schedule 1 to the Alpine Resorts Planning Scheme Erosion Management Overlay (EMO1). The area of the proposed works is shown in Figure 1.




**Figure 1: Area of proposed works (image from Nearmap)**

## 2.2 Proposed development

The proposed development at the site involves two walking trails and two lookouts comprising:

- Summit walking trail (825 m long)
- McLaughlin's Shoulder walking trail (240 m long)

- Summit viewing platform
  - This is proposed to include a walkway around the existing fire hut and suspended viewing platform on the north side.
- McLaughlin's Shoulder viewing platform
  - This is proposed to include multiple levels of wide, flat steel or concrete viewing decks.

RMB has provided concept drawings for the proposed viewing platforms, these include:

- Concept plans for the Summit viewing platform, by Creativelines.
- Concept plans for McLaughlin's Shoulder viewing platform, by Inspiring Place.
- Concept designs for both viewing platforms, by GMR Engineering Services,
  - October 2021 DWG MSL_02,
  - October 2021 DWG FTL_01.

Furthermore, RMB has provided a layout for the alignment of the proposed trails linking the observation points as shown in Figure 2. The green lines are the trails, and the green circles are observation points. The observation point south of the summit is proposed to be a flattened compacted gravel area at the switchback with no additional construction. Based on discussion with RMB, and from the concept plan for McLaughlin's Shoulder viewing platform, we understand that the proposed walking trails will be formed from compacted gravel surfacing.



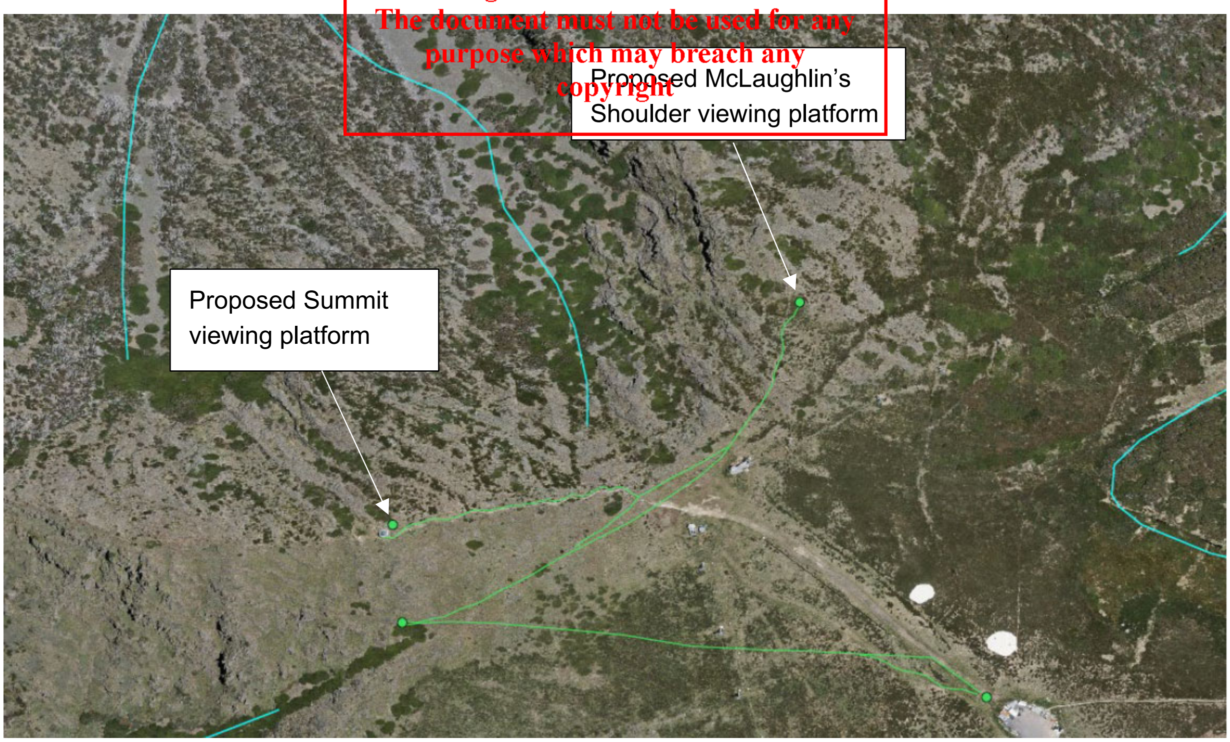


**Figure 2: Proposed layout (provided by RMB)**

## 3.0 AIMS OF THE ASSESSMENT

The aims of the geotechnical risk assessment and investigation set out in the report are set out below.

- The aims of the geotechnical risk assessment are to:
  - identify and map geotechnical hazards along the proposed trail alignments and lookouts;
  - conduct a landslide risk assessment along the trail alignment and at the lookouts and provide a report which addresses any requirements under the Alpine Resorts Planning Scheme, specifically the EMO;
  - work with RMB and other subconsultants to prepare a final trail alignment that reduces exposure to geotechnical hazards where possible, and;
  - make recommendations for risk mitigation measures, if required.
- The aims of the geotechnical investigation are to:
  - assess the existing ground conditions at the locations of the proposed developments, and;
  - provide recommendations for foundation design including types of foundations, rock detachment potential, allowable bearing pressure and ground anchor capacities.



## 4.0 METHODOLOGY

The assessment comprised a site walkover and desktop review of existing ground information within the vicinity of the proposed developments. The scope of works is set out below.

### 4.1 Information reviewed

As part of the desktop study, the following information was reviewed:

#### *Published geological information*

- 1:50,000 Scale Victorian Seamless Geology, 2014.
- Detailed unpublished Mount Buller geology map previously provided to Golder by Neville Rosengren as part of the Victorian Alpine Resorts risk assessment project.

#### *Previous studies in the area*

Information from a previous study in the area undertaken by Golder.

- Mount Buller – Victorian Alpine Resorts Geotechnical Risk Assessment Program 2018 – 2020 (Golder Associates).

#### *Aerial imagery*

- Historical imagery from Google Earth acquired between 2003 and 2019.
- Recent Nearmap imagery.

#### *Topography*

- LiDAR derived Digital Elevation Model from 2011.

## 4.2 Site walkover

The site walkover was performed on 26 October 2021 by an engineering geologist from Golder accompanied by Mr Daniel Argentov of RMB. Observations made during the site walkover included:

- Slope angles.
- The form of rock outcrop and distribution of loose rocks on slopes, including material type, block size and observations of fallen or loose cobbles and boulders.
- Potential founding material for viewing platforms.

# 5.0 RESULTS OF THE DESKTOP STUDY AND FIELD ASSESSMENT

## 5.1 Geology and Subsurface Materials

### 5.1.1 Geology

The 1:50,000 scale Victorian Seamless Geology indicates the surface geology at the Mount Buller Summit location to comprise hornfels of the Cobbannah Group. Most of the new trail, including all the observation points, is on this hornfels. The lower parts of the proposed trail, towards the summit car park, runs close to the contact with the Mount Stirling Granodiorite. The surface geology is shown in Figure 3. Orange is hornfels, white with pink plus signs is granodiorite and yellow is basalt.



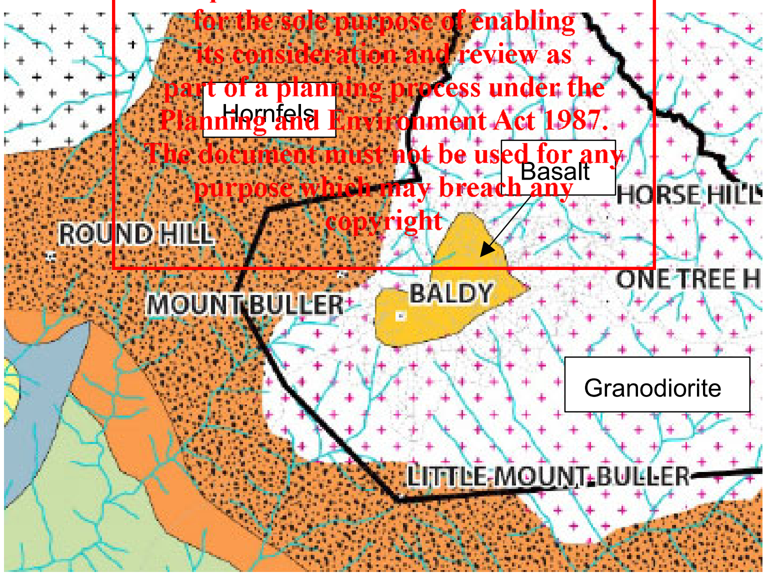


**Figure 3: Extract from geological map around Mount Buller (1:50,000 Scale Victorian Seamless Geology, 2014)**

Hornfels is a metamorphic rock which is generally of high strength and resistant to weathering. Outcrops of hornfels are visible on all sides of the Mount Buller summit. The less steep slopes towards the east and south of the summit consist of granodiorite which is typically more weathered. Weathered basalt of the Older Volcanics outcrops to the east of the summit, however, it does not extend west of the new snowmaking dam and so is not expected to be present in the proposed trail area.

### 5.1.2 Geomorphology and Landslides

Based on the desktop study and field visit there does not appear to be evidence for recent or repeated instability on the upper slopes of Mount Buller other than small scale rock fall. The landslide inventory collected as part of the Victorian Alpine Resorts risk assessment program did not identify any landslides in the vicinity of the proposed trail.

Assessment of LiDAR derived imagery acquired in 2011 does not show evidence of slope instability on the south side of the ridgeline between the summit and McLaughlin's Shoulder. Slope angles overlain on the LiDAR derived imagery are shown in Figure 4.

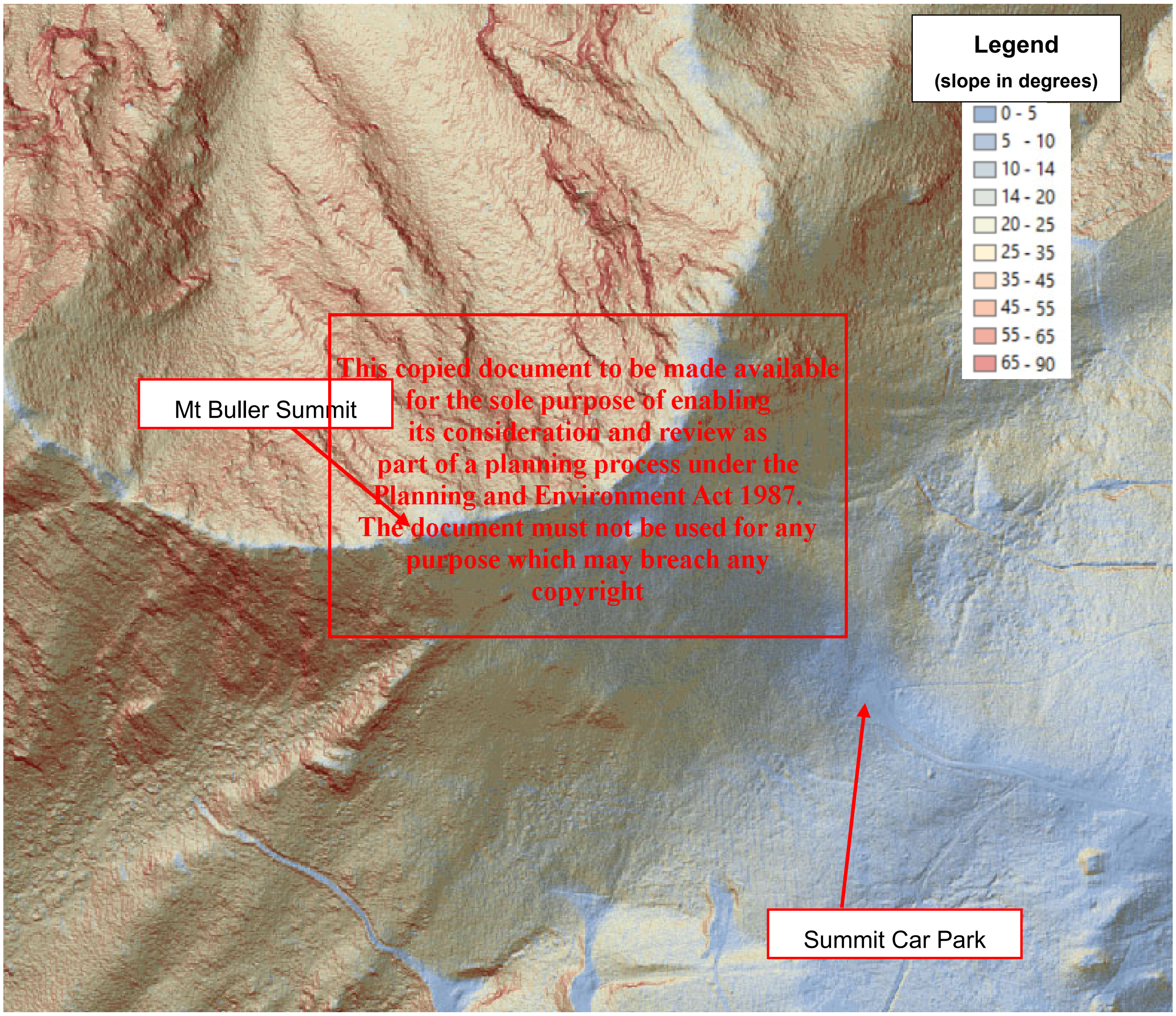



**Figure 4: LiDAR imagery with slopeshade (steeper slopes in red, less steep in blue) in the proposed trail area**

Rock fall from the outcrop on the south side of the ridge onto the trail and lower observation point is assessed to be a potential geotechnical hazard. The sections of trail in this area will be exposed to this hazard. The slope angle in this area is up to 35 degrees, as indicated in Figure 5. The approximate location of the observation point is in the low vegetation on the far side of the lower patch of snow.

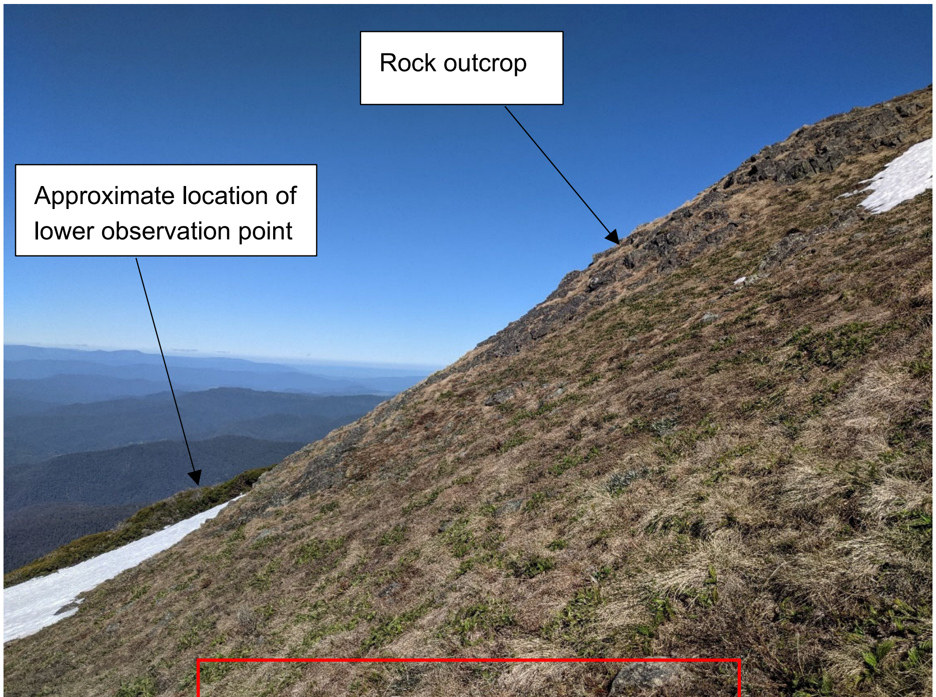


**Figure 5: Looking west along the proposed trail route between the Summit car park and the lower observation point**



There are numerous outcrops in this area which are generally blocky. Numerous loose cobbles and boulders were identified on the outcrops and across the vegetated slopes. These blocks are in the order of 0.1 m to 0.5 m diameter and mostly angular or tabular in shape. Figure 6 shows one section of outcrop with numerous loose blocks.

**Figure 6: Outcrop above proposed trail with numerous loose blocks**

### 5.1.3 Founding conditions at proposed viewing platforms

The proposed summit viewing platform and McLaughlin's Shoulder viewing platform are both at locations underlain by blocky, slightly weathered hornfels outcrop along ridgelines. The rock at both locations is very high strength. There is less than 0.1 m soil cover in minor patches at these locations.

#### *5.1.3.1 Mt Buller summit viewing platform*

The proposed viewing platform at the summit is to be a lookout deck protruding out over the north side of the summit with foundations anchored back into the rock below. This area is shown in Figure 7.

**Figure 7: Rock outcrop on the north side of Mount Buller summit**

There are two major joint sets in this outcrop. The orientation of the large flat face of the tabular blocks varies between 50°/065° (dip/dip direction) at the east to 50°/020° at the west. The shorter side is defined by a joint set at 50°/310°. The thickness of the tabular blocks varies between about 0.5 m and 0.8 m. Larger blocks at the east end are up to 2 m long, however, the block size tends to be smaller at the west end, mostly less than 1 m on the large face of the tabular blocks. The majority of the outcrop appears to comprise in-situ rock. Figure 8 shows a sketch of the founding conditions with some of the above observations annotated.

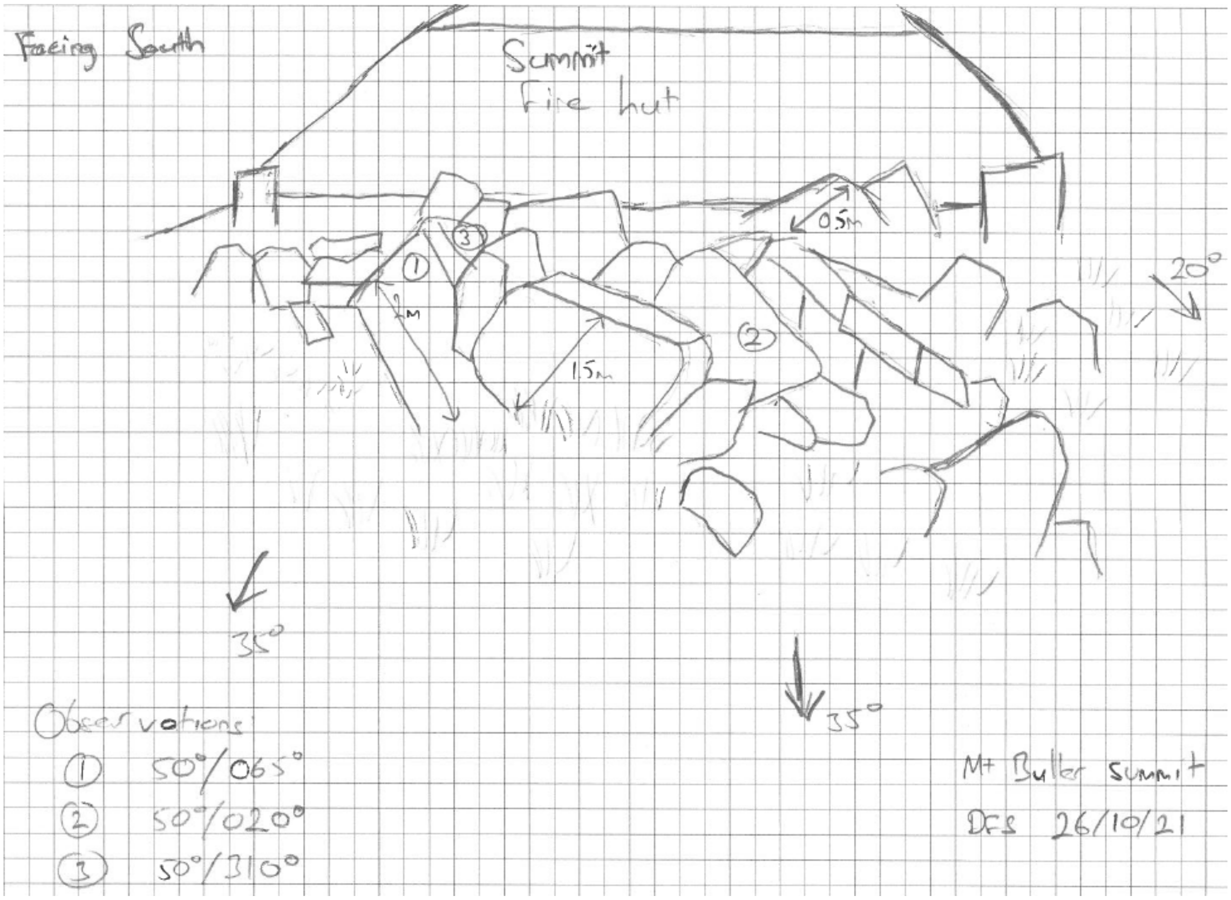


**Figure 8: Sketch of the proposed summit viewing platform founding conditions**

#### 5.1.3.2 McLaughlin's Shoulder viewing platform

The rock exposed at the proposed location of the McLaughlin's Shoulder viewing platform consists of tabular blocks with large face dimensions of generally 0.5 m to 1.0 m and thicknesses of 0.3 m to 0.6 m. There is a greater proportion of small loose blocks on the surface as well as more thin soil and vegetation at this location. Although the vegetation obscures much of the rock on the top of the ridge here, sections of in-situ outcrop were observed and the founding conditions for design purposes are considered to be generally the same at this location as at the Summit. Figure 9 shows a view of the proposed McLaughlin's Shoulder viewing platform area.



**Figure 9: Proposed McLaughlin's Shoulder viewing platform location**

# 6.0 RECOMMENDATIONS

## 6.1 Foundations

It is understood that the concept design for the Summit viewing platform involves shallow footings anchored to the underlying rock. If footings are supported on high strength rock, we recommend an allowable bearing pressure of 1000 kPa. The rock on which the footing is to be supported must be in-situ rock and free of loose material and debris. A suitably qualified geotechnical practitioner should inspect the footing locations prior to construction of the footing to ensure they are to be supported on in-situ rock free of loose debris.

Footings are likely to be anchored into the underlying rock. We recommend anchor design assumes the following:

- The anchor should extend through surficial rock blocks with the potential for detachment and anchor into in-situ rock. Based on site observations, the bond length of the anchors should be assumed to commence about 0.5 m below the ground surface.
- Ultimate ground/grout bond strength – 500 kPa.
- No anchor resistance over the initial 0.3 m of the bonded length of the anchor.

An appropriate factor of safety (typically 2.5) will need to be applied to the ultimate grout/bond strength calculated.

To check the anchor cone pull out failure mechanism, estimate the weight of the rock mobilised by the anchor system by assuming a cone around each anchor with 90° apex at the base of the anchor and extending up to the rock face surface and assuming a unit weight of 22 kN/$m^3$ for the rock within the calculated cone volume. Where cones from adjacent anchors overlap, the weight of rock in the overlapping volume should be only be considered once. The total weight of the rock mobilised by the anchor system, multiplied by a factor of 0.8, should be greater than the total applied (working) pull out load.

For example, based on:

- a 50 kN anchor working load;
- an 80 mm diameter borehole;
- a rock discontinuity 0.5 m back from the face and requirement to anchor below this;
- a 500 kPa ultimate grout/ground bond strength, and:
- a factor of safety of 2.5,

we estimate anchors will need to be approximately 1.5 m long.



We provide the following recommendations with respect to anchor type and anchor construction.

- Typical corrosion protection for steel components (i.e. anchor bars, head plates and nuts) would comprise:
  - galvanised and provided with a minimum 40 mm grout/shotcrete cover or;
  - comprised of stainless steel (or other) corrosion resistant elements.

However, we note that specific corrosion protection design requirements should be assessed by the structural engineer.

- If cementitious grout is used to secure the anchor in the borehole, grouting should be undertaken in a continuous operation so as to avoid the formation of cold joints within the grout. Grout should be injected using tremie techniques, commencing at the base of the hole using a grout tube. The collar of the hole should be plugged during the grouting operation to allow the grout to fully fill the borehole. Alternatively, chemical bonding techniques (Chemset) or other proprietary anchoring methods could be used. If open joints are encountered there is a potential for significant grout egress to the surrounding rock mass and in these circumstances, consideration may need to be given to the use of a grout sock or alternative construction methodology.
- All anchor holes should be drilled using air flush drilling techniques as well as flushing with air to remove debris prior to the installation of anchors. Anchors should be installed as soon as possible after drilling and not more than 24 hours after drilling.
- Centralisers should be equally spaced along the anchor bar with a minimum of 2 centralisers per anchor. The top centraliser shall be no more than 0.75 m from the top hole collar and the lower centraliser no more than 0.3 m from the end of the bar.
- The anchor contractor should provide a detailed design and construction methodology statement for review by the client or client's representative (structural engineer) prior to the commencement of anchor

installation. The design anchor loads should be confirmed by pull out testing and verified by a suitably qualified geotechnical engineer or structural engineer.

## 6.2 Earthquake

The methods of assessing earthquake risk classification and consequential design implications are outlined in Australian Standards AS 1170.4 (2007) 'Structural Design Actions Part 4: Earthquake actions in Australia'. The standard uses a number of factors in assessing an earthquake design category for a particular structure at a given site.

Based on the results of the desktop review a site Sub-Soil Class of $A_e$ may be adopted considering the depth of soil and type of rock identified at the viewing platform sites.

The hazard factor (Z) depends on the geographic location of the site. The hazard factor (Z) for the Mount Buller area presented in Figure 3.2(A) of AS 1170.4 – 2007 is 0.09.

# 7.0 GEOTECHNICAL ASSESSMENT

## 7.1 Geotechnical hazard identification

Based on the results of the desktop assessment the key geotechnical consideration relevant to the proposed trail and viewing points is assessed to be rock fall from the steeper slopes on the south side of the summit during both construction and operation. This area was identified as a potential rock fall runout area in the Victorian Alpine Resorts 2020 risk assessment program, an extract of which is shown in Figure 10.

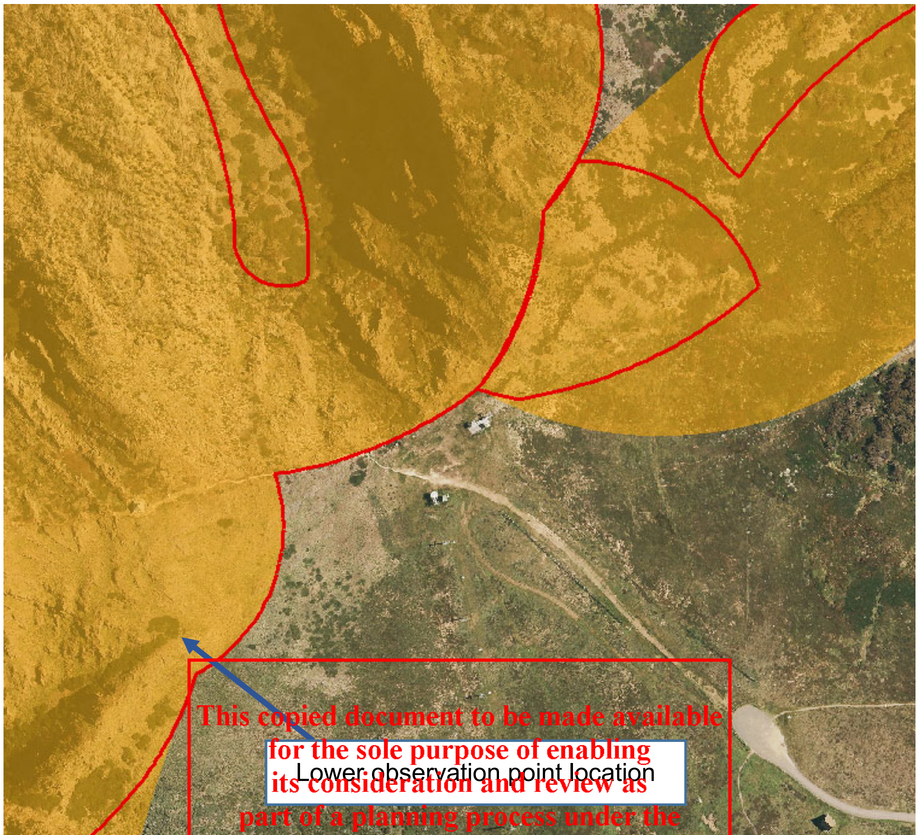


**Figure 10: Potential rock fall runout zones in orange (extract from Golder, 2020)**



The rock fall hazard provides a risk to life for users of the trail in the area below the summit and the lower observation point at the switchback. It is understood that the trail and lower observation point will be formed using compacted gravel track, therefore risk to property is not credible.

The proposed trail to McLaughlin's Shoulder, as well as the viewing platforms at the Summit and McLaughlin's Shoulder are not exposed to a rock fall hazard as they are along ridgelines, above the potential source area for rockfall. The potential for undermining due to rock fall is not considered credible assuming the foundations of the viewing platforms are suitably anchored into in-situ rock, as described in Section 6.1.

Other types of slope instability including natural shallow landslides and creep are not considered credible hazards to the proposed trial or viewing platforms due to the thin to non-existent soil cover. There is also no evidence of past deep-seated rock slides in this area.

## 7.2 Risk assessment

A qualitative risk assessment is required in accordance with the requirements Alpine Resorts EMO. However, the Australian Geomechanics Society Guidelines for Landslide Risk Management, 2007 (AGS 2007) recommend that a quantitative assessment be undertaken for hazards posing a risk to life. No credible risk to property has been identified, therefore only a quantitative risk assessment has been undertaken. Two hazard scenarios, Scenario 1 and Scenario 2 have been considered:

- Scenario 1: Rock fall impacting an individual standing at the lower observation point (static situation).
- Scenario 2: Rock fall impacting an individual walking along the trail (mobile situation).

In both scenarios the individual risk (risk to a single person) is very low as one person will only spend a few minutes in the zone of influence of the rock fall hazard. However, the societal risk, which takes into account that there will be many thousands of people passing through the area each year, is potentially significant. For calculation of the risk to life, the methods set out in the New South Wales National Parks and Wildlife Service Guidelines for Quantitative Risk to Life Calculations for Landslides (NSW NPWS 2020) have been used. These guidelines have been developed specifically for the assessment of risks in national parks and include specific methods for assessing risk to people on walking tracks and lookouts.

### 7.2.1 Scenario 1 (static case)

The risk to life of an 'average' individual in a static case (Scenario 1) may be calculated using Equation 1, as set out in AGS 2007c:

$$R_{(LOL)} = P_{(H)} \times P_{(S:H)} \times P_{(T:S)} \times V_{(D:T)} \qquad \text{(Eq. 1)}$$

Where:

$R_{(LOL)}$ = the risk or annual probability of loss of life of a typical individual who uses the track.

$P_{(H)}$ = the annual probability that a landslide or rock fall occurs.

$P_{(S:H)}$ = the probability of spatial impact of the landslide to the individual, i.e. a person on the section of trail subject to the hazard or at the observation point.

$P_{(T:S)}$ = the temporal spatial probability (e.g. of an individual being in in the path of the rock fall) given a rock fall or landslide reaches the location.

$V_{(D:T)}$ = is the vulnerability of the individual given they are in the path of the rock fall when it occurs.

The inputs to Equation 1 have been estimated for both situations.



**$P_{(H)}$ – the annual probability of rock fall occurring.**

Based on field observations it appears to be probable that a rock fall on the scale of 0.1 m to 0.5 m diameter will fall from any one of the outcrops each year. Frost jacking causing opening existing joints in the rock outcrop could be a rock fall trigger mechanism. Many joints were observed in the outcrop, however, many blocks that have already become loose are in stable locations and have settled immediately adjacent to, or close to, their original location.

Due to the jagged nature of the rock outcrop, and the high incidence of loose rocks observed amongst the outcrops or at the base, it is considered unlikely that a falling rock would travel beyond the base of the outcrop and onto the observation point at enough velocity to pose a credible risk to life. Therefore, the annual probability of a rock detaching and reaching a person at the observation point has been estimated at 1 in 10,000 (0.0001).

**$P_{(S:H)}$ – the probability of a falling rock reaching a person in the area at the base of the cut.**

This is the proportion of the lookout affected by the falling rock. The average size of rock expected to fall is taken to be 0.3 m and the length (perpendicular to the slope of the mountain) of the observation point as 5 m. The proportion of the observation area expected to be affected is therefore 0.06.

**$P_{(T:S)}$ – the temporal spatial probability given a rock fall or landslide occurs that it reaches the location.**

Assuming each person spends 3 minutes at the observation point during their visit, the temporal spatial probability can be calculated to be the total time that a person is at the observation point as a proportion of the whole year. This produces a probability of 5.7 x $10^{-6}$.

**$V_{(D:T)}$ – the vulnerability of the individual given they are impacted.**

A rock on the scale of 0.1 to 0.5 m diameter would need to strike a person above the waist to be a credible risk to life, however, the probability of a fatality in this case is likely. A person in the open is reasonably vulnerable to rock falls, and although there may be some warning, it would be expected due to the steep slopes and rocky terrain that a falling rock would quickly gain velocity. Appendix F of the Practice Note Guidelines for Landslide Risk Management 2007 (AGS 2007c) recommends a value for vulnerability of 0.5 for a person in open space struck by a rockfall. This is slightly above the middle of the range of recorded values which is considered reasonable for this situation.

**Evaluation**

Entering the above values into Equation 1, the calculated probability of loss of life, $R_{(LOL)}$, is 1.7 x $10^{-11}$. Table 1 of AGS 2007c suggests a tolerable limit of annual risk to life for new developments as 1 x $10^{-5}$. Acceptable risks are considered to be one order of magnitude lower than this: a probability of 1 x $10^{-6}$. Therefore, the risk to life of an individual, assuming that is the individual most at risk, is acceptable



Assessing the societal risk involves using many of the same inputs. This requires the calculation of an F-N pair.

**F – The probability of impact to the static element at risk (person at the lookout).**

F is calculated using Equation 2:

$$F = P_{(H)} \times P_{(S:H)} \qquad \text{(Eq. 2)}$$

These inputs are the same as for the individual risk calculation, so F = 6.0 x $10^{-6}$.

**N – The theoretical number of people expected to be killed if impact occurs.**

N is calculated using Equation 3:

$$N = e_s P_{(T:S)} V_{(D:T)} \qquad \text{(Eq. 3)}$$

RMB has indicated that the estimated visitation to the proposed trail is 43,000 visitors per year. For the static case this value is the exposed population, $e_s$. The other values are the same as above, so N = 0.12. Note that if the estimated visitation changes the risk assessment will also change.

**Evaluation**

The calculated societal risk is assessed using the Australian National Committee on Large Dams Guidelines on Risk Assessment (ANCOLD 2003), which has been adopted by the NSW NPWS as the criteria against which rock fall risks in national parks are evaluated. The calculated F and N are combined to create an F-N pair which is shown on an F-N plot and compared to set limits of acceptance. This is displayed in Figure 11 and shows that Scenario 1 is acceptable for societal risk to life.

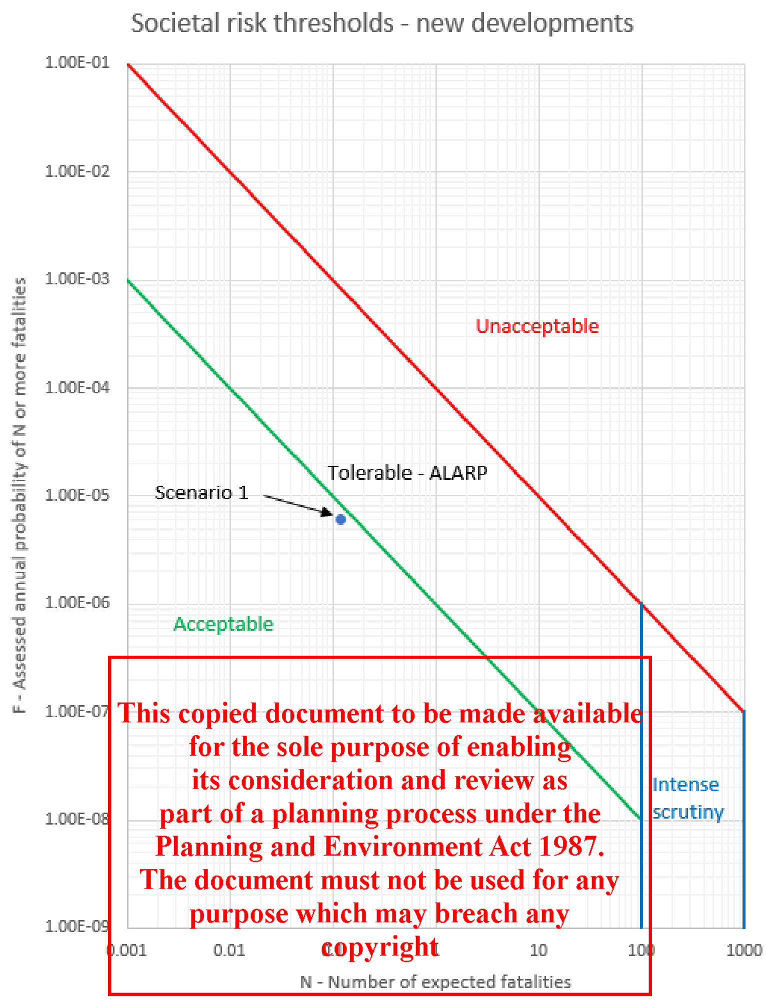




**Figure 11: F-N plot for Situation 1**

### 7.2.2 Scenario 2 (mobile case)

The risk to life of an individual in a mobile case (Scenario 2) may be calculated using Equation 4, the equation for mobile risk to life for rock fall with blocks up to 0.5 m diameter set out in NSW NPWS (2020):

$$R_{(LOL)} = P_{(H)}V_{(D:T)}n_i wfd \times 1.1 \times 10^{-7}/s_i \qquad \text{(Eq. 4)}$$

$P_{(H)}$ and $V_{(D:T)}$ are the same items as in the static case. However, the area from which rock falls could originate from that impact 150 m of trail is greater than that for the 5 m of the observation point. The probability of a rock fall occurring somewhere within a 150 m zone is therefore assumed to be greater than that that of the observation point, therefore $P_{(H)}$ has been increased by one order of magnitude to 1 in 1000 (0.001). $V_{(D:T)}$ is unchanged as the vulnerability of an individual struck by a falling rock is the same in all cases.

**$n_i$ – the number of traverses the individual most at risk makes within a year.**

As the trail is not a loop, this is assumed to be 2.

**w – the proportion of the width of the track affected by the rock fall.**

For a rock fall affecting a narrow walking track this is assumed to be 1 (the full width of the track).

**f – a reduction factor of between 0 and 1 relating to the probability of a person being present when the landslide is triggered (i.e. people less likely to be present on a hiking trail if a landslide is triggered by heavy rainfall).**

As the rock fall trigger is expected to be gradual frost jacking, there is no reduction factor applied for poor weather conditions, so this value is taken as 1.

**d – the length of the track that could be impacted by the landslide.**

For rock fall this is the expected boulder diameter, which is 0.3 m.

**$s_i$ – the speed in km/hr that the individual most at risk moves through the area subject to the hazard.**

Hikers typically travel at speeds of 2 to 3 km/hr. As this will be a relatively low to medium grade track, the speed has been assumed to be 3 km/hr.

**Evaluation**

Entering the above values into Equation 4, the calculated probability of loss of life for an individual, $R_{(LOL)}$, is 1.1 x $10^{-11}$. As discussed in the evaluation of the static case, the acceptable risk limit for the individual most at risk for a new development is 1 x $10^{-6}$. Therefore, the risk to life to the individual most at risk for Scenario 2 is acceptable.

Calculating the societal risk for the mobile situation again involves an F-N pair, although the method of calculation is slightly different than for the static case.

For a rock fall on a track, it is assumed that people walk along the track in single file and each hiker comprises one mobile element at risk, so N is equal to 1.

For mobile elements at risk, F is estimated using Equation 5. For this scenario, it is assumed that the individual most at risk is the same as the average individual.

$$F = 1 - (1 - R_{(LOL)})^n \qquad \text{(Eq. 5)}$$

**n – the total number of traverses made annually through the area at risk by the mobile element**

As described in the Scenario 1 risk calculation, it is estimated that the trail will have 43,000 visitors per year. Each person is expected to pass through the area at risk twice, so n is equal to 86,000.

Entering these values into Equation 5, F is calculated to be equal to 4.7 x $10^{-7}$.

**Evaluation**

The F-N pair calculated for Scenario 2 is assessed the same way as for Situation 1. The pair is shown on an F-N plot in Figure 12 and indicates that the societal risk to life for Scenario 2 is acceptable.

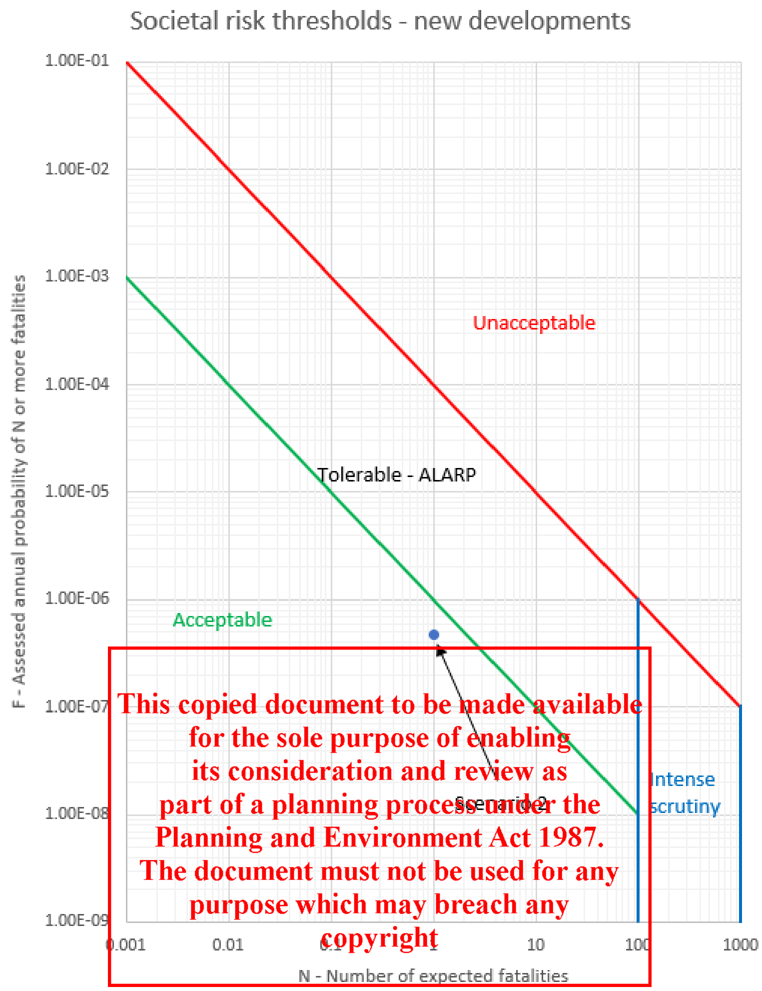




**Figure 12: F-N plot for Scenario 2**

### 7.2.3 Outcome of assessment

Based on the results of our assessment, we consider the risk to life from geotechnical hazards associated with the proposed track and viewing platforms development to be very low and to satisfy the requirements of the Alpine Resorts EMO1. With regards to these requirements, we consider the development suitable to proceed as proposed.

## 8.0 IMPORTANT INFORMATION

Your attention is drawn to the document 'Important information relating to this report' which is included in Appendix A of this report. The statements presented in this document are intended to advice you of what your realistic expectations of this report should be. This document is not intended to reduce the level of responsibility accepted by Golder, but rather to ensure that all parties who rely on this report are aware of the responsibilities each assumes in so doing. We would be pleased to answer any questions the reader may have regarding this document.

# 9.0 REFERENCES


- Alpine Resorts, Alpine Resorts Planning Scheme - Schedule 1 to Clause 4.01 Erosion Management Overlay (EMO1)
- Australian Geomechanics Society, 2007, Practice Note Guidelines for Landslide Risk Management 2007, 1 March 2007 (AGS 2007c)
- Australian National Committee on Large Dams, Inc., Guidelines on Risk Assessment, 2003 (ANCOLD 2003)
- Golder Associates, Victorian Alpine Resorts Geotechnical Risk Assessment Program 2018 - 2020 – Mount Buller, 17 September 2020
- New South Wales National Parks and Wildlife Services, Guidelines for Quantitative Risk to Life Calculations for Landslides, 16 January 2020 (NSW NPWS 2020)

# Signature Page

**Golder Associates Pty Ltd**

David Stretton
*Engineering Geologist*

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**APPENDIX A**

# Important information relating to this report

The document ("Report") to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd ("Golder") subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services ("Services") provided by Golder to its client ("Client") under and subject to a contract between Golder and its Client ("Contract"). The contents of this page are not intended to and do not alter Golder's obligations (including any limits on those obligations) to its Client under the Contract.

This Report is provided for use solely by Golder's Client and persons acting on the Client's behalf, such as its professional advisers. Golder is responsible only to its Client for this Report. Golder has no responsibility to any other person who relies or makes decisions based upon this Report or who makes any other use of this Report. Golder accepts no responsibility for any loss or damage suffered by any person other than its Client as a result of any reliance upon any part of this Report, decisions made based upon this Report or any other use of it.

This Report has been prepared in the context of the circumstances and purposes referred to in, or derived from, the Contract and Golder accepts no responsibility for use of the Report, in whole or in part, in any other context or circumstance or for any other purpose.

The scope of Golder's Services and the period of time they relate to are determined by the Contract and are subject to restrictions and limitations set out in the Contract. If a service or other work is not expressly referred to in this Report, do not assume that it has been provided or performed. If a matter is not addressed in this Report, do not assume that any determination has been made by Golder in regards to it.

At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.



Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder's affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

**Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification**

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