BEFORE THE COMMISSIONER APPOINTED BY THE CENTRAL OTAGO DISTRICT COUNCIL

RC180144

IN THE MATTER	Of an application for resource consent under section 88 of the RMA for earthworks and structures associated with the construction of a walking and cycling trail.
	Central Otago Queenstown Trail Network Trust
	Applicant

EVIDENCE OF JEFFREY BRYANT FOR THE CENTRAL OTAGO QUEENSTOWN TRAIL NETWORK TRUST

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My Background

1. My name is Jeffrey Bryant. I am the sole director and shareholder of Queenstown based consulting company, Geoconsulting Limited.

2. I am an Engineering Geologist with 42 years' experience and hold the qualifications BSc (geology) from Victoria University (1973) and MSc (engineering geology) from Canterbury University (1975).

3. I am a Fellow of the Geological Society (London) and by validation am entitled to the designation Chartered Geologist. I am also a member of the New Zealand Geotechnical Society and am affiliated through them to the International Association of Engineering Geologists.

4. I have read the Code of Conduct for Expert Witnesses within the Environment Court Consolidated Practice Note 2014 and I agree to comply with that Code. This evidence is within my area of expertise, except where I state I am relying on what I have been told by another person. To the best of my knowledge I have not omitted to consider any material facts known to me that might alter or detract from the opinions I express.

5. Over the past 24 years that Geoconsulting has been operating, I have been involved in the planning, construction and/or repair of the following dual-use trails and walking tracks:

    (a) Queenstown Trails (~ 120 km)

    (b) Cromwell Gorge Trail

    (c) Roxburgh Gorge Trail

    (d) Clutha Gold Trail

    (e) Alps2Ocean Trail

    (f) Te Anau-Manapouri Trail

    (g) Wanaka-Glendhu Bay

    (h) Many QLDC tracks

(i) Many DoC tracks in Fiordland, Mt Aspiring, Westland and Mt Cook National Parks and Central Otago Rail Trail.

6. From 1983-1988 I worked on the construction of the new road through the Cromwell Gorge followed by work on the Clyde Power Project Lake Shore Stabilisation Works. During and after lake fill (1993-2000) I was commissioned by Contact Energy to undertake walk-over surveys on both sides of the gorge. On the right bank, my route extended from Jacksons Creek through to Cornish Point. No evidence was found for any significant failures during that time.

Involvement in the case

7. I have prepared two reports for this application:

(a) A Geotechnical Assessment of the proposed Lake Dunstan Trail dated 13 March 2018 addressed to Southern Land Limited. That report has been included in the application documents as Appendix G.

(b) Subsequent to receipt of submissions on the application I was instructed to prepare a second report to evaluate the rock fall risk assessment for the Lake Dunstan Trail responding to issues raised by submitter Mr Royden Thomson. That report is dated the 13th of July 2018 and I understand was supplied by Southern Land Limited on behalf of COQTNT to the Council as part of a response to a section 92 request for information.

8. Rather than reproduce the two reports in full I confirm the contents of those reports are true and correct to the best of my knowledge and belief and have not altered my views subsequently. This evidence is therefore a summary of the key points arising from the reports I have provided.

Geomorphology and Geology

9. The right bank comprises moderate to steep slopes punctuated by occasional sections of very steep slopes leading up to bluffs. River terraces are first encountered in the upper gorge and are more common adjacent to the Kawarau Arm of Lake Dunstan. A few, older terrace remnants are present at higher levels but are limited in extent.

Schist bedrock underlies the hills flanking the Cromwell Gorge and is exposed as steep outcrops and bluffs throughout the right bank. A few old landslides have developed on the schist slopes together with some smaller landslide and rock fall features. Extensive colluvial deposits drape the footslopes beneath the rock outcrops and it is this material through which most of the trail will be aligned. In the Kawarau Arm, alluvial gravels and Tertiary sediments predominate.

Natural Hazards

10. The two largest landslides (Cairnmuir and Jackson Creek) have had extensive remedial works undertaken to improve stability. Neither these two nor any other known landslides have shown any signs of instability since lake fill. Debris from rock slides and rock falls is relatively common but the resultant colluvial slopes are mostly covered in soil and vegetation. Only one fresh rock slide was noted in the 18 odd years since walk-over surveys were abandoned. It was not possible to determine how many individual rock falls had occurred in the same period.

Geotechnical Considerations Associated with Trail Construction

11. Construction considerations were reported by Geoconsulting to Southern Land on 19 November 2013 and 13 March 2018. The right bank alignment comprises a combination of existing 4WD tracks (13.0 km) and new tracks (18 km) of which about 1.7 km of the latter will have to traverse rocky bluffs. The new tracks will be modest in scale and comprise sidling cut and fill, mostly in colluvial or alluvial materials. The existing tracks have been constructed in similar fashion and have performed well for the last 30-40 years. Retaining walls to support cut or fill slopes will only be used in exceptional circumstances where ground or slope limitations limit the use of conventional cut and fill slopes. Four areas were identified for site specific design although one of these is no longer an issue following the dropping of a second bridge crossing across the Kawarau Arm. Other key areas may be included once construction gets underway.

Bridge Crossings

12. Two major bridge crossings are proposed by Bannockburn Bridge and at Specularite Creek, in the middle of the gorge. Site specific investigations are programmed to enable detailed design of the bridge abutments and anchor locations. Some rock slope protective works may be necessary to secure these locations.

Rockfall risk assessment

13. A Quantitative Risk Assessment (QRA) of the rockfall hazard has been undertaken for the route as a whole to better inform the trail Principals, the Consenting Authority and trail users of the risks involved. This approach is considered to have more rigour than a qualitative risk assessment proposed by the peer reviewers and some submitters.

    The annual probability of loss of life to an individual (R(DI)) is calculated as the product of a number of conditional probabilities. Two scenarios, involving either an individual rock fall or a small rock slide have been considered to give R(DI) values ranging from $2x10^{-8}$ to $2x10^{-9}$. This compares favourably with other risks such as lightning strike and in fact you would have more chance of winning Lotto first division. However, given an estimated usage of around 10,000 people per year, total risk rises to $2x10^{-4}$ to $2x10^{-5}$ for all users. This is close to the national level of risk for whitewater rafting.

Risk evaluation

14. An attempt has been made to determine what is an acceptable level of risk for this activity. While a wide range of risk attitudes is given in the literature for various activities it is felt that adoption of the risk evaluation procedures used by the Department of Conservation is appropriate. Using DoC methodology, the trail would rate as marginally tolerable/intolerable for fatalities but tolerable for injuries. The risk profile could be managed by lowering the rockfall threat and installing signage to alert and modify trail users behaviour. It would not be feasible to apply corrective measures to every loose rock or potential area of rock fall but it would be fitting to undertake some scaling of key areas at the time of construction to remove loose rock threatening the trail. More

comprehensive engineering measures, such as rock fences/barriers, anchoring, meshing or drapery are not considered appropriate given the usage and the cost of construction versus cost of repairs. Adoption of both scaling and signage will move the risk profile further in to the tolerable zone.

Response to section 42A report:

14. The Section 42A report acknowledges the submissions by Royden Thomson and WSP Opus and picks up on the main points. In its decision making, Council is guided by a previous resource consent application RC100199, Roxburgh Gorge Trail, in which Commissioner Nugent notes:

"*It is not the function of the RMA to remove all risk. Rather, we should ensure that people are aware of the risks that they may encounter and let them decide what level of risk they will take."*

We concur with this and propose appropriate signage to alert people of risk before entering key areas where rockfall hazard is deemed to be higher than average.

Response to submissions received:

15. Submission of Roydon Thomson: Mr Thomson has submitted on three issues, namely;

- Visual Effects
- Rockfall Hazards and Risks
- Trial Tenability

I will respond to the last two points. The rockfall hazard is well known and it is acknowledged that the risk is greater in some areas than others. Those sections deemed particularly vulnerable will be subject to closer scrutiny and mitigation measures such as rock scaling by specialist abseil crews will be instigated prior to construction. There are many, if not most, trails that may be susceptible to 'major mass movement events at a later date'. Some may have suffered closure through such events

but generally a way is found to reopen the trails once funding is made available. An exception is some of the trails in Mt Cook and Westland National Parks where glacial retreat has changed the landscape beyond recognition. I do not believe that concerns regarding future mass movements are grounds for not granting consent.

16. Reviews by WSP Opus (dated 11 July 2018 & 4 November 2018). WSP Opus have reviewed two of the four reports that Geoconsulting have produced on behalf of COQTNT but have not undertaken a site inspection either on foot or by boat. Their reviews focus on natural hazard risk assessment (in particular rockfall) and engineering input to trail construction. For both aspects they recommend provision of a high level of engineering input in terms of design, compliance to engineering standards, documentation and future management. These requirements are more appropriate for structures or facilities of high value, high strategic importance, high consequence of failure and /or high threat to safety. The Cromwell Gorge Trail does not meet those characteristics and of the other trails or tracks I have worked on, only a few have required specifically designed cut slopes or retaining walls. In practice, trails have typically gone through a 'shake-down' period in the year or two following construction and some additional maintenance is required to clear up any failures or deficiencies in trail design. This established trail construction methodology has proved to be pragmatic and cost-effective.

    WSP Opus' discussion on risk assessment is somewhat confusing as they consider 'qualitative methodology' to be preferable to the industry best practice 'quantitative risk assessment' as used in my report and in the GNS Port Hills study[1]. They note that:

    "*The report does not provide any commentary as to the number of potential sites or the likely occurrence of rockfall from each nor does it*

[1] Massey, C.I., McSaveney,M.J., Heron,D., Lukovic, B. (2012) Canterbury Earthquakes
2010/11 Port Hills Slope Stability: Pilot Study for assessing life safety risk from Rockfalls (boulder rolls), GNS Science Consultancy Report 2011/311.

consider the trail in its entirety in terms of rockfall frequency other than 'few.'"

The number of potential rockfall sites is probably in the hundreds of thousands and it would not be possible to comment on each one. Normal practice in hazard assessment of transportation corridors is to assess the route in its entirety, which I have done comprehensively in Geoconsulting report 'SouthernLand180621' dated 13 July 2018. The term 'few' is not mentioned in that report.

Elsewhere they note that:

"As such we are unable to agree with Geoconsulting's opinion that the assessment of likelihood and consequence would result in a ***low or extremely low risk to trail users****."*

This phrase is never mentioned in any of my reports.

I believe most of Opus' concerns would have been satisfied by a closer reading of my reports or by caucusing to resolve any misunderstandings or differences in opinion.

Summary and conclusions

17. A geotechnical appraisal and Qualitative Risk Assessment have been made and the following conclusions have been reached:

    (a) Construction of the proposed trail alignment is technically feasible.

    (b) Key areas will require a more detailed assessment of the rockfall and rockslide hazard with some intervention in the form of mitigation or protective measures most likely required.

    (c) There is no accepted metric for acceptable versus unacceptable risk to recreational users of such a trail.

    (d) From the available information, it is indicated that the individual risk of rocks causing a fatality is R(DI) = $2x10^{-8}$ to $2x10^{-9}$. For an estimated 10,000 users per year, the total risk becomes $2x10^{-4}$ to

$2x10^{-5}$ per annum which is close to or within the acceptable level threshold of 1 in 10,000, as set out in the AGS document LR7[2].

(e) The rock fall risk to trail users is comparable to a range of recreational pursuits such as:

(a) White water rafting;

(b) Rock climbing

(c) Tramping;

(d) Cycling on public roads in the presence of traffic (for example state highway 8 on the opposite side of the lake).

18. It is beyond my expertise to recommend an acceptable risk threshold to trail users. This is an individual decision that can only be made by trail users themselves armed with appropriate risk information to decide whether to make use of the particular trail. Some people may be highly risk averse and may choose not to use the trail. Others may be attracted to the trail for the very reason that it traverses the type of terrain that presents a risk. Personal risk decision making is a common feature of recreational pursuits and the proposed cycle trail is no different. In my opinion COQTNT's approach to managing the geotechnical risk is orthodox and appropriate.

Jeffrey Bryant
Date: 13 November 2018

[2] (AGS), A. G. S., 2007. Practice Note Guidelines for Landslide Risk Management,
Journal and News of the Australian Geomechanics Society 42(1), pp. 63-114.