Memorandum

To	Environmental Protection Authority
From	Ross Lawerence, NZSki
Re:	Request for Further Information FTAAQ-2605-1236 Climate Change Resilience and the Remarkables Ski Area Upgrades and the Doolans Expansion Project

Introduction

In relation to the sought concession for the Remarkables Ski Area Upgrade and Doolans Expansion Project ("**the Project**"), the Environmental Protection Authority ("**EPA**") requested the following further information from NZSki Limited ("**NZSki**") under section 46(2) of the Fast-track Approvals Act ("**FTAA**") in a letter dated 4 June 2026. This letter said:

> 4. *DoC has also noted that "although the application acknowledges climate change and how the Doolans proposal is able to improve the resilience and extend the longevity of the ski area generally, due to its south facing aspect; this appears to assume that the Doolans Basin itself is not also affected by climate change… Insufficient information has been provided about how the Project, including new developments proposed in the Doolans Basin itself is consistent with a precautionary approach to developing a ski area in the face of climate change, noting the 40-year term sought. Climate change data and assessment supporting an expansion into the Doolans for the purpose of operating a ski area over the proposed term of the next 40 years, in the face of climate change, is absent.*
>
> *Relevant to the matter of climate change effects on the upgrade and expansion project, please provide:*
>
> a. *With reference to sub-clause (d) - Information addressing Ski-fields Policy 3.25.2 of the Otago Conservation Management Strategy, which requires the*

application of a precautionary approach … the likely longevity of the field in the face of climate change, and any appropriate land remediation and facility removal costs should the ski field cease to operate; and

b. *With reference to sub-clause (g) - Information addressing the potential climate change effects on the land and its conservation values should climate change make the activity unviable in the future.*

NZSki is the operator of three ski areas in the South Island, and it is aware of the potential risks that a warming climate and increasing snow lines has on the viability of its existing and future operations. Such matters influence NZSki's long term strategic planning and investment across its ski areas, including decisions such as to advance the proposed Remarkables Ski Area Upgrades and Doolans Expansion Project.

In response to the request by the EPA, the following memo will:

1. Provide an overview of the scientific evidence that has supported NZSki's decision to advance the Project;
2. Provide an overview of snow accumulation data spanning 40 years, as recorded by NZSki at the Remarkables Ski Area;
3. Provide relevant and applicable examples of recent technological advancements that have improved the reliability and longevity of the winter ski season elsewhere; and
4. Summarise the Project's proposed land remediation and facility removal requirements.

This memorandum responds directly to, and addresses the comments in, the request for further information that "*Climate change data and assessment supporting an expansion into the Doolans for the purpose of operating a ski area over the proposed term of the next 40 years, in the face of climate change, is absent*".

The Current State of Knowledge

In 2012, Hendrikx et al. published research on the potential effects of climate change on seasonal snow in New Zealand. The authors present their findings in two parts, with the first providing a nationwide assessment, and the second focusing on implications for the ski industry. Part II also includes an analysis of the ski industry's ability to mitigate or adapt to

climate change through technological intervention. Both papers are attached to this memorandum in Appendix **A**. Although this research is now almost 15 years old, its overall findings remain relevant. The papers are the most current assessments for climate change impacts on snow in New Zealand.

The authors' projections indicate a widespread decline in New Zealand's snowpack across all elevations under all climate change scenarios by the 2040s and 2090s. Key snow metrics (including snow water equivalent[1] (**"SWE"**), snow duration, and the fraction of precipitation falling as snow) all show consistent decreases, with the largest relative impacts occurring at lower elevations and in regions east and north of the Main Divide (2012, 613-614). Additionally, Hendrikx et al. find that a rising snowline is also likely, with the elevations that support snow cover for at least three months of the year projected to increase by 0 to 200 m by the 2040s and 150 to 450 m by the 2090s (2012, 614).

Notably, whilst high elevations may experience increases in maximum SWE, this finding is of limited significance as such elevations (those greater than 2900 m) cover less than 0.01% of New Zealand's land area (2012, 615).

Hendrikx et al. conclude part I by outlining that the result of their modelling is aligned with their understanding and global knowledge of snow process – there are predicted to be relatively larger declines of SWE at lower elevations and potential increases of SWE at the highest elevations (2012, 615).

In part II Hendrikx & Hreinsson go on to examine the possibility that the ski industry in New Zealand may be able to make up the short fall in seasonal snow through technological measures (2012). The authors reiterate that climate change will reduce the natural snow available at all the sites considered in this study, with the number of snow-days negatively correlating to the elevation of the site (2012, 628). However, the analysis undertaken in this part demonstrates that, even under worst-case scenario, snowmaking is viable at all 10 examined sites into the 2090s, including at The Remarkables (2012, 629). Notably, areas located above 1650 m in elevation will experience more gradual changes as compared to areas lower in elevation. As such, ski areas such as The Remarkables will retain a

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[1] Used as the rate of snow accumulation.

consistent winter snow season (though possibly shortened), with substantial and reliable snow depths suitable for snow-based activities (2012, 628).

Furthermore, Hendrikx & Hreinsson find that snowmaking can make-up the deficit in the natural snow, increasing the number of snow-days up to 1990s levels at all sites considered in this study (2012, 629). They do note a caveat that the analysis adopts minimum snow levels for operation. Additionally, although it remains possible at all sites, potential snow-making hours also decrease (again negatively correlated with elevation).

Overall, the authors summarise how their research highlights the importance of considering technological advancements (in terms of the ability to make snow) when considering climate change impacts on ski areas. Their analysis draws on similar conclusions made globally - adaptation to climate change (in this case being technological advancements) will be key to retaining operations at ski areas situated at lower elevations (2012, 629).

The Doolans Basin

Climate change will certainly impact the level of seasonal snow seen in New Zealand, however, both altitude and latitude are significant factors in shaping how this difference is felt. Overall, the findings presented by Hendrikx & Hreinsson indicate that The Remarkables ski area benefits from high altitude and favourable latitude (2012). Furthermore, the south-east/south-facing aspect of The Remarkables means that the sun does not reach many of the faces with direct sunlight. Each of these characteristics work to support greater snow retention and facilitate reliable winter operation as the climate warms. Supporting this assertion, Hendrikx & Hreinsson find that for the location representative of The Remarkables, even under the most severe scenarios evaluated it is likely that the area will have snow into the 2090s (2012, 627; Table 4).

For the reasons outlined above, the expansion into the Doolans Basin, with its higher altitude and south easterly aspect are central to the project rationale. Additionally, the Doolans Basin operates as a snow catchment, able to hold greater amounts of snow for longer periods. This is due to the prevailing west to north-west weather through The Remarkables, which constantly transports snow from the Rastus Burn basin to the Doolans.

NZSki also note that the basin contains sufficient water to enable snow making activities to occur, whilst maintaining key residual flows to avoid adverse downstream effects from water

take. These aspects of the Doolans Basin will enhance the resilience of the ski field as climate and weather patterns change and will secure the longevity of the ski field for the duration of the sought concession.

Tracking Snowfall in the Remarkables Ski Area

NZSki does not hold records for snow accumulation in The Doolans basin specifically but has kept records for The Remarkables Ski Area since its inception in 1985. Figure 1 below sets out this data and demonstrates an overall upwards trend in annual snow accumulation.

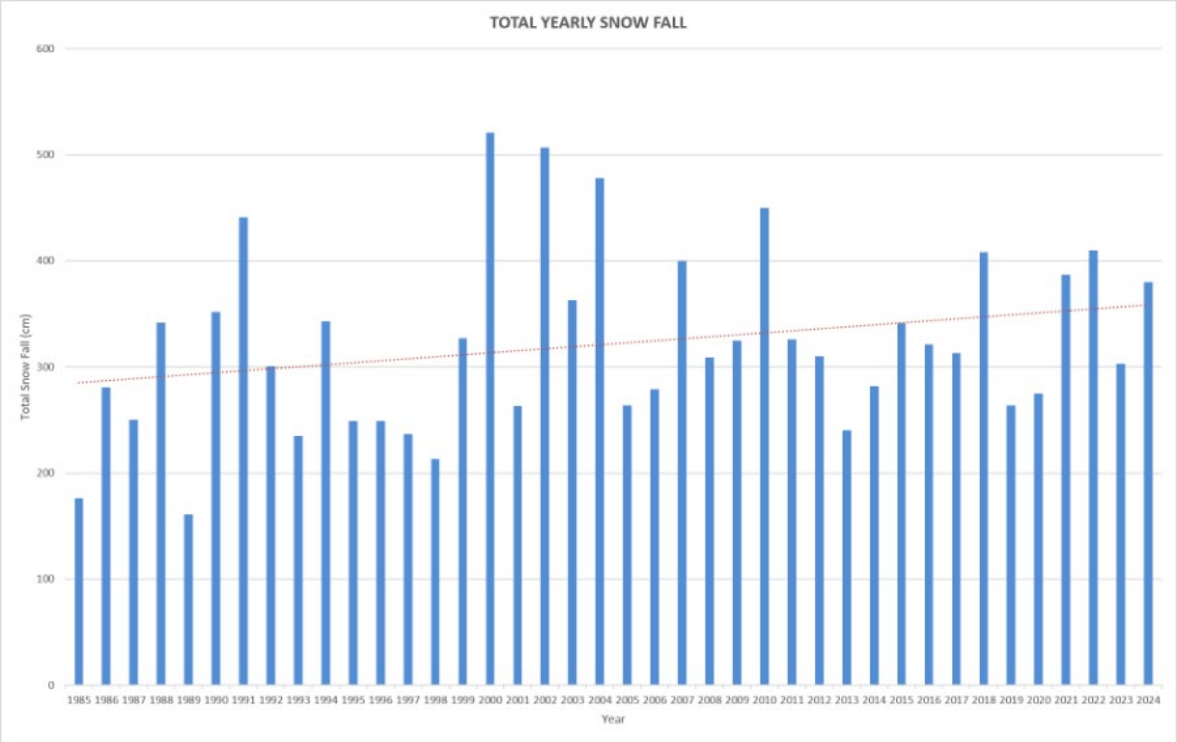

Figure 1: Snow accumulation at the Remarkables Ski Area - 1995 to 2024.

As illustrated by the graph above, NZSki is well accustomed to variations in yearly snowfall. This data combined with the findings of Hendrikx & Hreinsson (2012) provide reasonable confidence that NZSki will be able to adapt to any decreases in seasonal snow - particularly given any change is to be gradual at these elevations. Mitigating factors such as snow-making technology will assist in retaining suitable conditions for snow-based activities, with expansion into the Doolans Basin further securing resilience and longevity of the ski area overall.

Technological Advancements and Improved Reliability and Longevity

Advancements in snowmaking technology will continue to support the longevity of the Remarkables Ski Field by improving the efficiency of snow making and broadening the weather conditions under which snow can be produced and distributed. Advancements in snow making technology to date include:

- A modern snow producer is capable of producing 50% more snow than the technology of 15-20 years ago in New Zealand alpine ski field conditions.
- The start-up temperatures for a modern snow producer are now -1.5^{o}C wet bulb whereas 15-20 years ago guns would not produce until -2.5^{o}C and the product would be quite wet.
- Modern snow making creates light and dry real snow and makes for amazing trail skiing, which can be refreshed regularly with snowmaking to provide a great skier experience.
- This modern technology now uses 15- 20% less power per m^3 of snow than the older snow making guns, and the efficiency of newer systems continues to improve.
- No two winter seasons are alike and snow making systems are designed to be reliable under a broad range of weather conditions, ensuring they can continue to operate in a variety of climate conditions.
- Based on data from over 100,000 snow producers worldwide, Technoalpin (the provider for NZSki's snow making technology) is confident that technology will keep up with current trends in climate change well into the future.
- Various ski industry suppliers are now refining a snow making 'factory' which utilises refrigeration techniques to produce snow /ice flakes regardless of the temperatures. These units are now available commercially and are in place in 2 NZ ski resorts producing up to 1,000m^3 of snow per day each. NZSki has one in place at Coronet Peak and is already benefiting from the early season reliability of the product to accurately determine opening day each season. In most cases, natural refrigerants can be used to produce snow in an even more environmentally friendly, energy-efficient way. Refrigerant levels remain very low thanks to continuous innovation.

Advancements in snow making technology will therefore continue to support the longevity of alpine ski fields, including the Doolans Basin expansion, in the face of changing climate conditions.

Ceasing of Operations

NZSki's commitment to delivering high-quality snow experiences now and into the future sits at the core of its business values. The company has established a strong reputation for the consistent renewal and upgrade of infrastructure across all its operations. NZSki actively strives to remain at the forefront of innovation and sustainability, with a focus on enhancing the natural environment while delivering a product that meets and exceeds expectations.

Where questions have arisen regarding the remediation of sites altered under NZSki's concessions, the company's accountability and responsibility for reinstatement are clear and demonstrable. NZSki consistently exemplifies best practice in restoring the natural landscape, with a proven track record of returning sites to at least their original condition, and in some cases enhancing them as part of the remediation process.

NZSki anticipates the longevity of the ski area will extend well past the 40-year term of concession sought. However, in the unlikely event that the ski area should cease to operate by the end of the concession term, proposed Special Condition 102 of Schedule 3 of the Proposed Concession Document addresses land remediation and facility removal actions following termination or expiry of the concession in a manner that is consistent with other similar concession agreements ensuring the conservation values of the land will be appropriately protected following cessation of the activity.

Proposed Condition 102 requires NZSki to undertake required remediation at their cost. Specifically, condition 20.4 (proposed by Special Condition 102) requires that, following termination or expiry of the concession:

- The Concessionaire must remove any specified structures and other improvements on the Land if given written notice by the Grantor to do so.
- All above ground specified structures and other improvements must be removed to ground level unless otherwise agreed.
- Removal must occur within the time specified by the Grantor.

- The Concessionaire is to make good any damage and leave the Land and other public conservation land affected by the removal in a clean and tidy condition and replant the affected Land with indigenous vegetation of a similar abundance and diversity as that which existed generally in the vicinity prior to the structures or improvements being installed.[1]

NZSki notes that these conditions are wholly consistent with NZSki's existing (and recently renewed) Remarkables Ski Area concession.

Conclusion

The evidence developed by Hendrikx et al. (2012) and Hendrikx & Hreinsson (2012) confirms that climate change will result in a reduction in natural snow availability across New Zealand over time, with the most pronounced impacts occurring at lower elevations. However, the research also demonstrates that high-altitude ski areas are comparatively well-positioned to retain viable snow conditions into the long term, particularly when supported by technological intervention. As such, the characteristics of The Remarkables Ski Area demonstrate the long-term reliability that can be gained by an expansion into the Doolans Basin. Its elevation, southerly aspect, and natural snow catchment benefits contribute to strong natural snow retention. Collectively, these factors significantly enhance the resilience of the ski area in the face of a changing climate.

In parallel, long-term snowfall records demonstrate that NZSki has successfully operated within a highly variable snow environment for decades. This operational experience, combined with ongoing investment in infrastructure and adaptive technologies, provides confidence in NZSki's ability to respond effectively to future climatic variability.

Overall, the evidence supports the conclusion that, with the implementation of technological measures and strategic expansion into the more resilient terrain of the basin, The Remarkables Ski Area can continue to provide reliable snow activities for future generations to enjoy.

Notes on the Author

Ross Lawerence is a respected, trusted, and highly knowledgeable figure within the ski industry. Over a distinguished 40-year career (17 of those years as Manager of The

Remarkables Ski Area until his retirement in 2025) he demonstrated strong leadership, overseeing and driving significant growth and development at the mountain. Widely regarded for his expertise, Ross remains deeply connected to the industry and retains a genuine passion for all things snow.

In the 2025 King's Birthday Honours, he was appointed a Member of the New Zealand Order of Merit in recognition of his extensive services to the ski industry.

References

Hendrikx, J., E. Ö. Hreinsson, M. P. Clark, and A. B. Mullan. "The Potential Impact of Climate Change on Seasonal Snow in New Zealand: Part I—An Analysis Using 12 GCMs." *Theoretical and Applied Climatology* 110, no. 4 (2012): 607–618. https://doi.org/10.1007/s00704-012-0711-1.

Hendrikx, J., and E. Ö. Hreinsson. "The Potential Impact of Climate Change on Seasonal Snow in New Zealand: Part II—Industry Vulnerability and Future Snowmaking Potential." *Theoretical and Applied Climatology* 110, no. 4 (2012): 619–630. https://doi.org/10.1007/s00704-012-0713-z.