Mt Hotham Alpine Resort Final IWM Plan

June 2025

Three Seeds

wave
CONSULTING

Traditional Owners

We acknowledge Gunaikurnai, Taungurung, Dhudhuroa, Waywurru and Jaithmathang as First Peoples with connection to Country that includes Mt Hotham Alpine Resort. First Peoples language, knowledge and concepts referenced in this document remain the cultural and intellectual property of those First Peoples.

Document Management

Version	Date	ID	Authors
1 – Initial draft	8 April 2025	2023-030-D41	Laura Cacho, Rob Catchlove, Ross Allen (Three Seeds)
2 – Final draft	18 June 2025	2023-030-D48	Laura Cacho, Rob Catchlove, Ross Allen (Three Seeds)

Disclaimer

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Cover image

Mt Hotham Resort. Source: ARV.

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Executive Summary

This Integrated Water Management (IWM) Plan establishes a framework for managing water and water systems at Mt Hotham Alpine Resorts over the next 20 years. It has been prepared to inform water planning in support of the economic viability and ecological and cultural values of the resorts in a changing climate.

The plan considers water supply and demand (potable and snowmaking), stormwater management, wastewater treatment – all within the context of a Victorian alpine environment. It has been developed in consultation with ARV and resort stakeholders and informed by ARV's ongoing engagement with Traditional Owners/Custodians.

Resort Context

Mt Hotham is in the Victorian Alps. This area is significant to many First Peoples including Gunaikurnai, Taungurung, Dhudhuroa, Waywurru and Jaithmathang. Information on First Peoples water-related connections to this area is documented in *Integrated Water Management in North East Victoria's Alpine Region*.[1]

Located five hours from Melbourne on the Great Alpine Road between Bright and Omeo, Mt Hotham sits at a summit elevation of 1,861 metres and is considered the most challenging ski terrain of all the Victorian resorts. It is bounded on all sides by the Alpine National Park.

The Mt Hotham Village is stretched along the Great Alpine Road, with about 5,000 bed spaces. The population at Mt Hotham is highly seasonal. In 2021, the permanent population at Hotham Heights was 128 people, but in the busy winter months, the population can exceed 4,000 people each day.[2]

Mt Hotham is located at the headwaters of four major rivers: the Kiewa, Mitta Mitta, Dargo (Mitchell), and Ovens[3]. The North East catchment is managed by the North East Catchment Management Authority (NECMA).

The southern slopes of the resort feed into the Dargo River, a tributary of the Mitchell River within the East Gippsland catchment, which also includes the Tambo and Snowy Rivers. The East Gippsland catchment is managed by the East Gippsland Catchment Management Authority (EGCMA).

As the land manager, ARV. has a responsibility to preserve, protect and enhance biodiversity within the Resort, as per the Mt Hotham Environmental Management Plan (2021)[4].

Water Context

Mt Hotham's water supply comes from Upper Swindlers Creek, a catchment of approximately 177 hectares. The upper Swindlers Creek watershed is a protected catchment at elevations between 1800m and 1450m. It sources water from groundwater, snowmelt, and precipitation.

Mt Hotham Alpine Resort operates a multifaceted and integrated water infrastructure system tailored to meet both potable and snowmaking demands. The potable water supply is sourced from the pristine Upper Swindlers Creek catchment, with minimal development and reliable year-round flow. Water is gravity-fed through a well-engineered system, stored at

[1] Three Seeds (2025). *Integrated Water Management in North East Victoria's Alpine Region.*
[2] Alpine Resorts Victoria (2022). *Drinking Water Quality Annual Report, 2022 – 2023*.
[3] Mount Hotham Alpine Resort Management Board (2021), *Environmental Management Plan.*
[4] Mount Hotham Alpine Resort Management Board (2021), *Environmental Management Plan.*

Mt Higginbotham, and treated via UV disinfection before distribution. Wastewater is processed using an activated sludge treatment plant, and further refined to Class A quality for reuse in snowmaking. Snowmaking operations are primarily supplied by the 28 ML Loch Dam reservoir, with an average annual usage of 140 ML, incorporating both Class A recycled water and direct creek extractions. The snow production system comprises over 110 fan guns and is designed to minimize potable water impacts by drawing from downstream weirs.

Water demand at the resort is variable, influenced by climate conditions and visitor numbers. The resort holds a 175 ML/year diversion license for potable use from Swindlers Creek, with all meltwater returning to local waterways. Although total annual water availability is not a limiting factor, challenges arise from storage constraints and timing, particularly in autumn, where low flows and high pre-season snowmaking demand may coincide. Risk modelling indicates a 7% likelihood of water stress, assuming reliance solely on Swindlers Creek and daily demand not exceeding 1.5 ML. The resort continues to evolve its infrastructure with climate-resilient technologies, including more efficient snow guns and emerging snow factory systems, to secure water resilience amid changing environmental conditions.

Climate Context

Victoria's alpine resorts, including Mt Hotham, face significant challenges from climate change, which is forecast to impact on a variety of environmental values, and the local and state economy. Key changes include:

- declining snowfall and natural snow depth
- decreasing annual precipitation
- rising temperatures
- reduced hours suitable for snowmaking using snow/fan guns
- increased reliance on snow factories
- increased risks of bushfires and extreme weather events.

Projected temperature increases would significantly alter the natural snow coverage, depth and overall visitor experience, reinforcing a transition to a hybrid use of natural snow, snowmaking with fan guns, and snow factories

Climate change is reducing natural snowfall and the effectiveness of snow guns, increasing reliance on snow factories. Effective water planning and management at Mt Hotham is critical to the ongoing resort operation and visitor experience.

Cultural Context

Traditional Owner groups representing First Peoples identifying connections to the Mt Hotham area include Gunaikurnai, Taungurung, Dhudhuroa Waywurru Nations, Duduroa Dhargal, Jaithmathang TABOO and Jaithmathang TO. Gunaikurnai and Taungurung are Registered Aboriginal Parties (RAPs) under the Victorian Aboriginal Heritage Act (2006). Other Traditional Owners groups are involved in ongoing negotiations on formal recognition under State and Federal legislation.

Water Management Options

The IWM plan evaluated 21 options across four water management categories. Stakeholder input and analysis was used to identify 16 priority recommendations. These are listed below.

<u>Good Water Management</u>

1. Building cultural understanding and two-way knowledge sharing
2. Seek water related TO partnerships opportunities
3. Water metering
4. Systematic leak detection
5. Water efficiency
6. Snowmaking water efficiency
7. Maintenance
8. IWM Reporting

Environmental Management

9. Stormwater management and erosion protection (trial)

Future Water Resilience

10. Additional storage capacity (business case)
11. Groundwater extraction (investigation / stakeholder engagement)
12. Formalise additional Swindlers Creek diversion
13. Rainwater harvesting trial
14. Groundwater investigation (business case)
15. Stormwater harvesting (business case)
16. Storage cover (monitoring/investigation)

Strategic Alignment

Recommendations align with ARV's strategic objectives (investment, environment, visitors, reform, progress, and people) and IWM outcomes. Potential benefits include:

- enhanced water security and climate resilience
- water infrastructure and services supporting visitor experience
- support for Traditional Owner cultural values and self-determination
- more sustainable and efficient water use across resort operations.

Implementation is contingent on ARV priorities, available resources (including grant funding), and stakeholder support.

Action Plan

Suggested actions based on priority recommendations are summarised below.

Immediate / Current

- Continue developing relationships with Traditional Owners and build understanding of cultural values of water at Mt Hotham
- Ongoing water system maintenance and mapping

Short-term (1-3 years)

- Implement systematic leak detection systems (including submetering) and improve building water efficiency
- Implement annual reporting covering all water aspects (stormwater, wastewater, potable, snowmaking, efficiency)
- Install erosion control measures (logs, coir logs) in identified risk areas below car park edges; monitor effectiveness
- Investigate the business case for increasing storage capacity at Loch Dam
- Investigate the business case for additional diversion licence on Swindlers Creek
- Investigate rainwater tank installations for toilet flushing at high-usage areas
- Investigate the potential for groundwater to supplement potable supply and increase resilience

Medium-term (4-9 years)

- Assess the potential of stormwater harvesting for snowmaking (multiple locations identified)
- Measure evaporation losses from storage ponds to inform consideration (benefit-cost) of storage pond covers

Long-term (10+ years)

- Review water demands for snow making in relation to ongoing climate change impacts.

1 Introduction

1.1 Purpose of this plan

The purpose of this plan is to provide a comprehensive framework for managing water resources at Mt Hotham Alpine Resort (referred to in this report as Mt Hotham) in a way that balances environmental sustainability, social needs, and economic considerations. By integrating diverse aspects of water use—supply, wastewater, stormwater, and environmental flows—the plan seeks to optimize the overall performance of water systems while addressing challenges like climate change, visitation growth, and resource scarcity. It promotes collaboration among stakeholders to align goals and actions. Ultimately, this plan aims to ensure the long-term availability and quality of water, protect ecosystems, enhance resilience, and support resort function in a coordinated and efficient manner over the next 20 years.

1.2 Overview of Mt Hotham Alpine Resort

Mt Hotham is in the Victorian Alps. This area is significant to many First Peoples including Gunaikurnai, Taungurung, Dhudhuroa, Waywurru and Jaithmathang. Information on First Peoples water-related connections to this area is documented in *Integrated Water Management in North East Victoria's Alpine Region*.[5]

[5] Three Seeds (2025). *Integrated Water Management in North East Victoria's Alpine Region.*

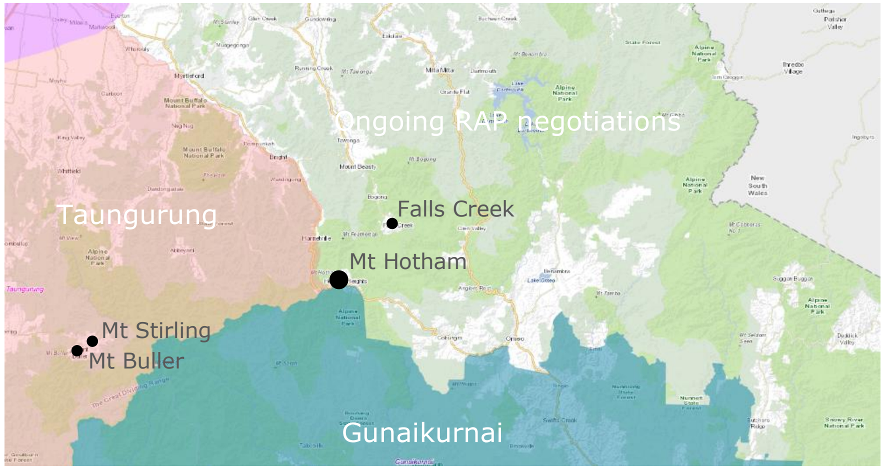


Figure 1. Alpine Resorts in North East Victoria and Registered Aboriginal Party (RAP) areas (Source: Victorian Aboriginal Heritage Register and Information System, annotated with Victorian Alpine Resorts)

The land, water and skies are of great significance to First Peoples of North East Victoria's alpine region. Everything here has been created by ancestral beings, the signs of which are deeply intertwined with all aspects of existence. For countless generations, to coincide with the annual bogong moth migration, Nations from around Victoria would travel to the alpine peaks to take part in ceremonies, feast on the nutritious moth, trade, settle disputes and perform marriages.

Source: Alpine Shire: Bright and Surrounds - First Peoples (visitbright.com.au/things-to-do/arts-and-culture/museums-and-history, accessed January 2025)

Located five hours from Melbourne on the Great Alpine Road between Bright and Omeo, Mt Hotham sits at a summit elevation of 1,861 metres and is considered the most challenging ski terrain of all the Victorian resorts. It is bounded on all sides by the Alpine National Park.

The Mt Hotham Village is stretched along the Great Alpine Road, with about 5,000 bed spaces. Furthermore, Dinner Plain Village, also situated above the snow line, is a 10-minute drive from Mt Hotham and adds accommodation, food, and other activities to the resort's offer. The population at Mt Hotham is highly seasonal. In 2021, the permanent population at Hotham Heights was 128 people, but in the busy winter months, the population can exceed 4,000 people each day.[6]

Figure 2. Mt Hotham Terrain Map (Source: Mt Hotham Alpine Resort)

In the white season, the resort is highly regarded by experienced skiers and snowboarders as it has the high proportion advanced terrain of any ski resort in Australia.[7] There are also areas suitable to beginner skiers, an extensive cross-country skiing network, and a small snow play area that includes a toboggan slope.

Mt Hotham has had little focus on developing as a green season destination. It has not invested as much in mountain biking, cycling, or other summer activities like other Victorian resorts.[8] However, that focus is increasing, and visitors are often drawn to the area for walking and touring along the Great Alpine Road.

Table 1. Mt Hotham Profile

Statistics	***Values***
Winter Visitation (2024)	255,157 visitor days
Summer Visitation (2021/22)	179,092 visitors
Resort Size	3,450 ha
Resort Altitude (Village)	1,765 metres
Distance from Melbourne	365 km
Number of food establishments	12
Number of accommodation beds	5,000
Cross-country skiing	35 km
Snowmaking terrain	38 ha
Skiable terrain	320 ha
Number of lifts	11
Road cycling	30 km
Mountain biking	25 km
Walking	90 km

Source: Urban Enterprise (2021)[9], ARV (2025)[10]

[6] Alpine Resorts Victoria (2022). *Drinking Water Quality Annual Report, 2022 – 2023*.
[7] Urban Enterprise (2021). *Victorian Alpine Resorts Visitor Economy Development Plan*. Prepared for Tourism North East. Brunswick, VIC: Urban Enterprise Pty Ltd.
[8] Ibid.

[9] Urban Enterprise (2021). *Victorian Alpine Resorts Visitor Economy Development Plan*. Prepared for Tourism North East. Brunswick, VIC: Urban Enterprise Pty Ltd.
[10] ARV (2025). *Visitation statistics*. https://www.alpineresorts.vic.gov.au/the-resorts/visitation-statistics (accessed 14 March 2025).

Water plays a critical role at Mt Hotham, particularly in supporting the resort's operations and environmental sustainability. The resort relies on water for snowmaking, an essential part of ensuring reliable skiing conditions throughout the winter season. Snowmaking systems use water to create artificial snow when natural snowfall is insufficient, especially during warmer or dry spells. This helps maintain the resort's ski terrain, attracting visitors and ensuring a consistent ski experience. Water is also vital for the resort's broader infrastructure and various recreational and operational purposes, including water supply for guests, food preparation, and cleaning.

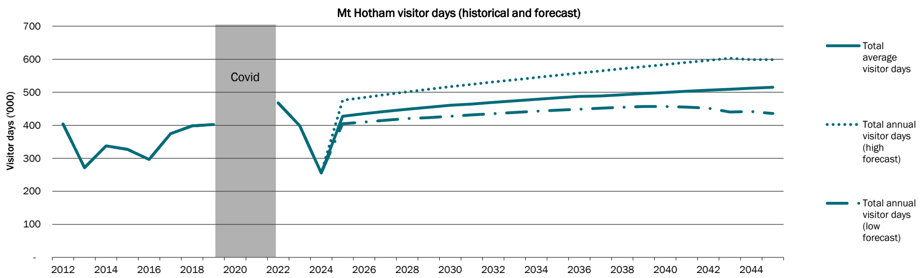


Figure 3. Historic and Projected Total Number of Visitor Days Under Different Snow Scenarios (data provided by Centre for International Economics, 2024).

The economic viability of the alpine resorts are under pressure as a result of climate change and increasing climate variability. Without adaptation, shorter snow seasons and reduced winter visitation may impact revenue and make diversification and year-round operations increasingly important. Figure 3 shows historic and projected visitor days for Mt Hotham under different scenarios (average year, low snow year, and high snow year), assuming an adaptation scenario where half of the natural snow reduction from climate change is alleviated through snowmaking.[11] With snowmaking, visitor days may remain similar to historic numbers or even exceed the current counts of visitor days.

> "The goal should be to give people what they want without sacrificing the biodiversity that is in these environments."
>
> *Workshop 1 participant*

The alpine environment surrounding Mt Hotham is recognised as a site of significance. There are 10 fauna species and 105 flora species of state significance within the Resort, according to the Victorian Biodiversity Atlas, and there are four species nationally listed under the Environmental Protection and Biodiversity Conservation Act: the Alpine She-Oak Skink, Broad-toothed Rat, Mountain Pygmy Possum, and Alpine Tree Frog. [12]

[11] Centre for International Economics. (2024). *Carrying Capacity of Victorian Alpine Resorts: Preliminary Draft Report*. Prepared for Alpine Resorts Victoria, 30 September 2024. The Centre for International Economics.

[12] Mount Hotham Alpine Resort Management Board (2021), *Environmental Management Plan.*

1.3 History of snow depth at the resort

Snow depth data has been recorded since 1988 at the resort, on a daily basis, providing an excellent basis for considering changes in climate and their impact on water management. The chart below shows the depth for each season, and the long-term trend. It is rare to get more than 2 metres of snow depth on the mountain, and it would normally only remain on the mountain for a few weeks or up to a month, due to rain and warmer weather melting the snow.

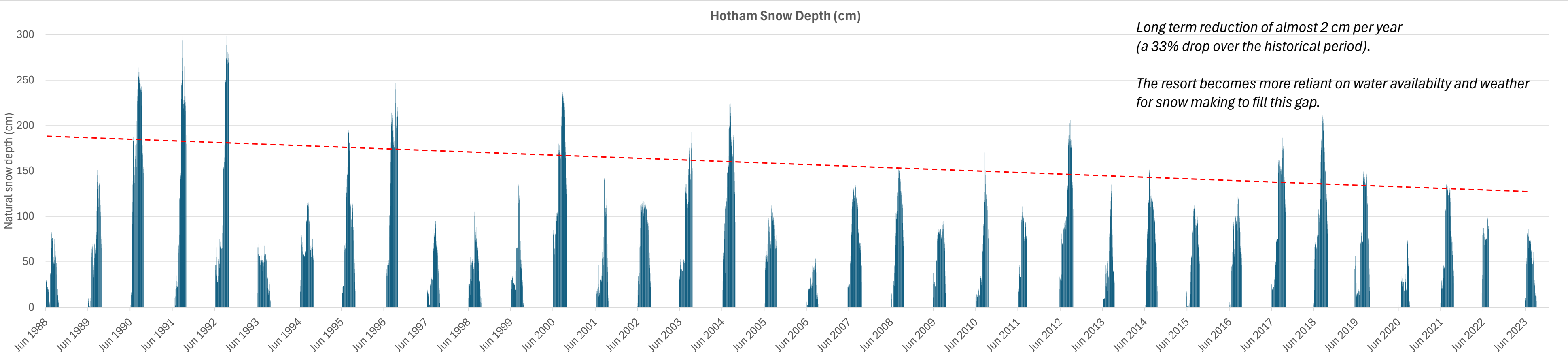


Figure 4. Snow depth at Mt Hotham Alpine Resort since 1998.

1.4 Water planning approach

An iterative process was used to understand the resort context, water and environment context, identify potential opportunities, and evaluate options (see figure to the right).

Wave Consulting worked with ARV and Mt Hotham stakeholders to understand and explore the resort's water-related context, aspirations and challenges through a series of informal interviews and two online workshops. Wave Consulting visited the resort with ARV staff to assess existing infrastructure and ground-truth potential opportunities.

The first workshop focused on understanding the role of water, as well as constraints and opportunities for better water management at the resort. The second workshop identified as well as critiqued potential options. Inputs from both workshops formed the basis of what options are presented in this plan. See the Appendix for summaries of the outcomes from each workshop.

Multiple stakeholders participated in the workshops and were provided the draft plan for review, including DEECA, Goulburn Murray Water, North East Water, Vail Resorts, Alpine Shire, and several ARV staff.

ARV are engaging with First Peoples of North East Victoria as part of the development of ARV's Traditional Owner Engagement and Self-Determination Strategy. Traditional Owners have not been directly involved in water planning for Mt Hotham; however, cultural considerations and associated water-related opportunities have been identified with reference to relevant Traditional Owners Country Plans, strategies and other information.[13]

[13] Three Seeds (2025). *Integrated Water Management in North East Victoria's Alpine Region.*

2 Water context

2.1 Waterway Catchments

Mt Hotham is located at the headwaters of four major rivers: the Kiewa, Mitta Mitta, Dargo (Mitchell), and Ovens:[14]

- *Kiewa River Catchment*: Originating in the Victorian Alps, the Kiewa River flows northward, joining the Murray River near Wodonga.
- *Mitta Mitta River Catchment*: Formed by the confluence of the Cobungra and Big Rivers, the Mitta Mitta River is a major tributary of the Murray River. The Cobungra River itself rises below Mount Hotham and Mount Loch, highlighting the resort's contribution to this catchment.
- *Dargo (Mitchell) River Catchment*: The Mitchell River, known locally as the Dargo River in its upper reaches, flows southward, eventually reaching Lake King and the Gippsland Lakes system.
- *Ovens River Catchment*: The Ovens River rises near Mount Hotham and Mount Feathertop, flowing northwest to join the Murray River near Lake Mulwala.

Mt Hotham is located predominantly within Victoria's North East catchment (see Figure 5) which includes the Kiewa, Ovens, and Mitta Mitta river systems within the upper Murray River catchment. The North East catchment is managed by the North East Catchment Management Authority (NECMA).

The southern slopes of the resort feed into the Dargo River, a tributary of the Mitchell River within the East Gippsland catchment, which also includes the Tambo and Snowy Rivers. The East Gippsland catchment is managed by the East Gippsland Catchment Management Authority (EGCMA).

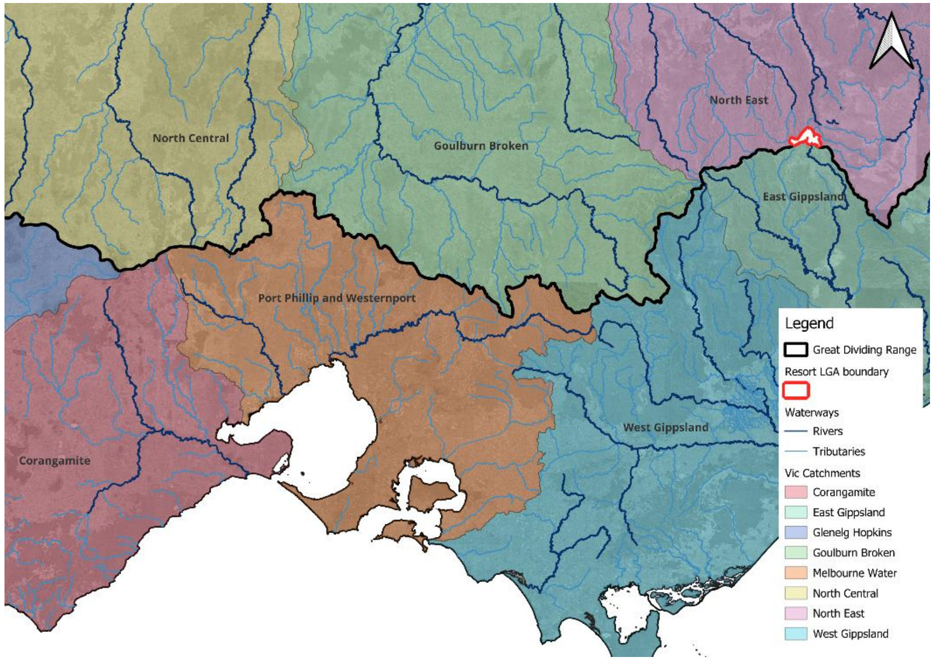


Figure 5. Mt Hotham resort in the context of surrounding catchments

As the land manager, ARV has a responsibility to preserve, protect and enhance biodiversity within the Resort, as per the Mt Hotham Environmental Management Plan (2021)[15].

The first Environmental Management System (EMS) was in place in 2014, and the first EMP was drafted in 2018, and then updated in 2021. The EMS has involved the development of the State of the Environment (SoE) Report, reviewing operational data and knowledge of environmental values within MHAR, and an Environmental Management Plan (EMP) outlining goals and actions informed by the SoE. The SoE and EMP are reviewed and updated

[14] Mount Hotham Alpine Resort Management Board (2021), *Environmental Management Plan.*

[15] Mount Hotham Alpine Resort Management Board (2021), *Environmental Management Plan.*

every three years. The RMBs operational and strategic Risk Registers are regularly reviewed and updated for alignment to the EMP. The SoE and EMP were last reviewed in 2018. In 2021 the SoE was updated and forms the basis for targets set in this current EMP.

The diverse functions of the RMB and sensitive nature of the alpine environment means that many aspects of operations impact a variety of environmental values. This EMPs format follows on from previous versions and is divided into sections focusing on five key environmental values:

1. Production, Waste and Consumption
2. Atmosphere
3. Land Management
4. Biodiversity and Threatened Species
5. Water

Mount Hotham Alpine Resort has high biodiversity values with several threatened species persisting within the Resort. Additionally, the alpine and sub-alpine environment are particularity sensitive and thus Resort operations need to be sympathetic and compatible. Land management aspects that impact biodiversity include threatened species management, construction and development, tourism, environmental programs including weed and predator control, education and promotion activities, and research funding and support.

From a planning perspective there are several mechanisms that must be considered and addressed for all changes to the landscape in this alpine environment, under the Alpine Resorts Planning Scheme[16], including clauses on the following issues:

- Protection of biodiversity
- Native vegetation management
- Environmental significance overlays
- Bushfire management
- Sustainability development
- Erosion management.

Figure 6. View of upper reaches of Swindlers Creek (Source: Wave Consulting Australia)

[16] DEECA, 2025. Per comms feedback on the draft on the subject of biodiversity considerations and planning scheme detail in alpine environments. 1st May 2025, via email.

2.2 Water Infrastructure

2.2.1 Water Supply

Mt Hotham's water supply comes from Upper Swindlers Creek, a catchment of approximately 177 hectares. The upper Swindlers Creek watershed is a protected catchment at elevations between 1800m and 1450m. It sources water from groundwater, snowmelt, and precipitation. Small tributaries provide reliable year-round flow to Swindlers Creek, with significant increases during rain events. The catchment has minimal development, limited to winter ski field activity, with no permanent habitation or sewage discharge. [17]

Figure 7. Swindlers Creek Weir #1 (Source: Wave Consulting Australia)

2.2.2 Raw Water Storage

The resort's water is collected at the Swindlers pipeline inlet headwall and flows by gravity to the pump station. It is then pumped through a pressure-rising main to storage tanks at the summit of Mt Higginbotham.[18]

Figure 8. Raw water storage at Mt Higginbotham (Source: Wave Consulting Australia)

[17] Alpine Resorts Victoria (2022). *Drinking Water Quality Annual Report, 2022 – 2023*.

[18] Ibid.

2.3 Water Treatment

From the Mt Higginbotham storage tanks, the raw water flows to one of two UV facilities for disinfection before entering the reticulation system for supply to consumers through the village water reticulation system.[19] All drinking water supplied through the reticulation network is gravity fed with no pumps involved.

Figure 9. Wastewater treatment along Davenport Drive (Source: Wave Consulting Australia)

2.3.1 Wastewater

Mount Hotham operates a comprehensive wastewater treatment system. The primary facility is a biological treatment plant based on activated sludge principles, which effectively processes sewage and wastewater generated within the resort. Adjacent to this facility is a Class A recycled water treatment plant that provides additional treatment to achieve Class A water quality standards.[20]

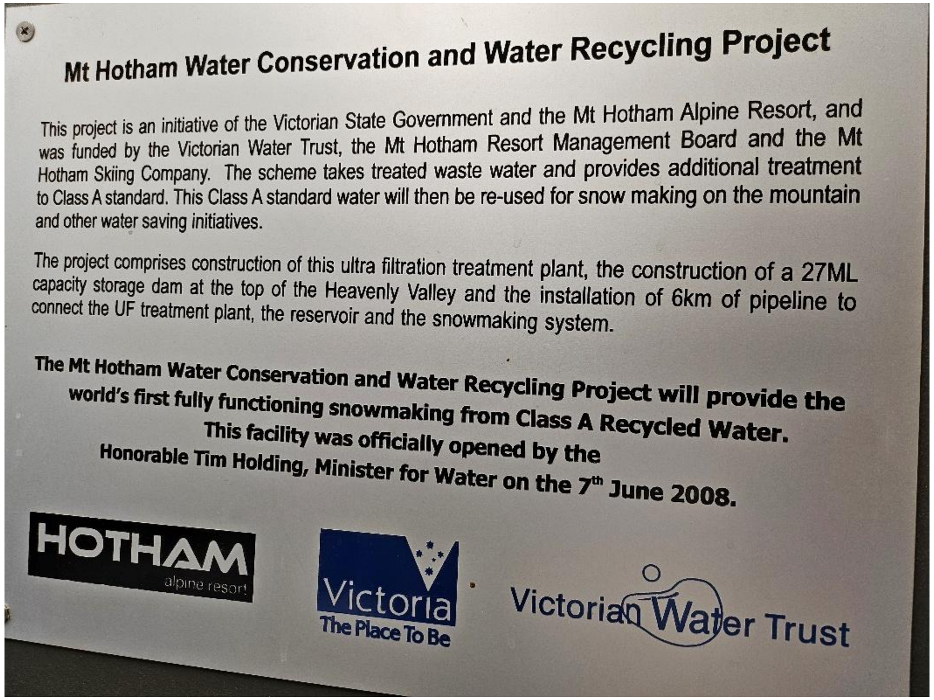


Figure 10. Signage of Recycling Plant at the WTP

[19] Ibid.

[20] Hotham Alpine Resort (2025). "*Waste water*," https://rmb.mthotham.com.au/Our-Services/Utilities/Waste-Water (accessed 19 March 2025).

2.4 Snowmaking

At Mt Hotham, snowmaking water is supplied by the Loch Dam, a 28 megalitre reservoir that is filled from a weir and Class A recycled water from Mt Hotham's waste water treatment plant. [21] This reticulation is largely independent of the drinking water supply system. The weir that supplies the snowmaking water is downstream of the drinking water weir in Swindlers Creek. Only the snowmaking operation on Big D Ski area draws water from the drinking water storage tanks.[22]

To produce snow, Mt Hotham has a coordinated system of over 110 snow (fan) guns, including three at Dinner Plain, which use high pressure water and compressed air to create the ice crystals. Some of the guns are permanent towers, and others are mobile guns.[23]

Snowmaking is delivered to ski runs downstream of the Swindlers Creek offtake, to avoid impacting on the extraction of raw water for potable use.

Figure 11. Loch Dam at near full supply (Source: Wave Consulting Australia)

The data on water use for snowmaking is shown below, recorded since 2010. It shows that the main area for snowmaking is 'mainline'. The volumes vary with season and capacity, and average 140 ML per year.

[21] Coia, Anita (2018). "Taking on the snow gods," https://www.mthotham.com.au/discover/connect-with-us/latest-news/2018/taking-on-the-snow-gods (accessed 19 March 2025).
[22] Alpine Resorts Victoria (2022). *Drinking Water Quality Annual Report, 2022 – 2023*.
[23] Coia, Anita (2018). "Taking on the snow gods," https://www.mthotham.com.au/discover/connect-with-us/latest-news/2018/taking-on-the-snow-gods (accessed 19 March 2025).

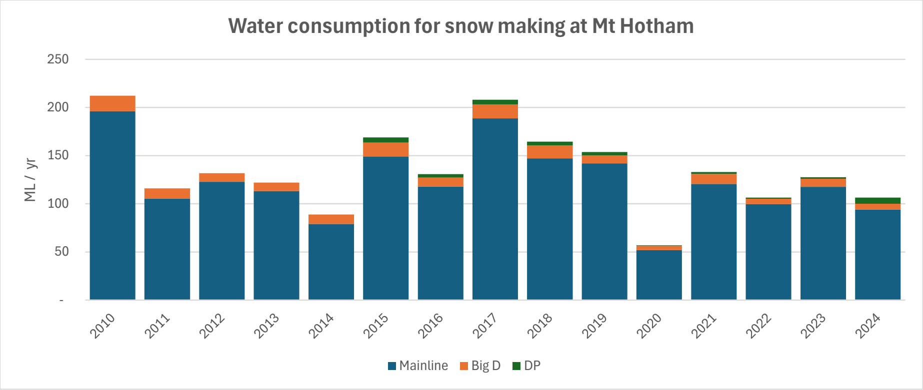


Figure 12. Historical water use for snowmaking (Source: ARV)

There is an ongoing movement in the industry to adapt and transition snow making infrastructure in response to climate change. The use of more efficient snow fan guns, more sensors to calibrate and target snow production, and the installation of snow factories will continue to deal with a changing climate and a more consistent coverage of snow.

The future of snow making at Mt Hotham may well include a hybrid mix of more efficient snow guns, operating at slightly higher wet bulb temperatures, and snow factories, where snow produced lasts longer on the ground.

2.5 Water Demand

An analysis of water demand patterns is based on monitored data of water consumption (closely related to the scale of visitation). For Mt Hotham, there is over ten years of daily data on the potable water used each day, and daily data on water used for snowmaking for the past five years.

Data on visitation figures to the resort, local rainfall records, nearby weather data (temperature, humidity, wet bulb, and wind direction and speed at an hourly interval), and river monitoring at a downstream station on the Swindlers Creek was in later modelling, in parallel to the usage data, for the two main uses of water:

- Potable water for all accommodation, toilets, buildings, administration and workshop
- Snowmaking production

Year to year the water demand fluctuates based on weather, visitation rates, leakage in the system, and other climate variables. The figure below represents the average demand.

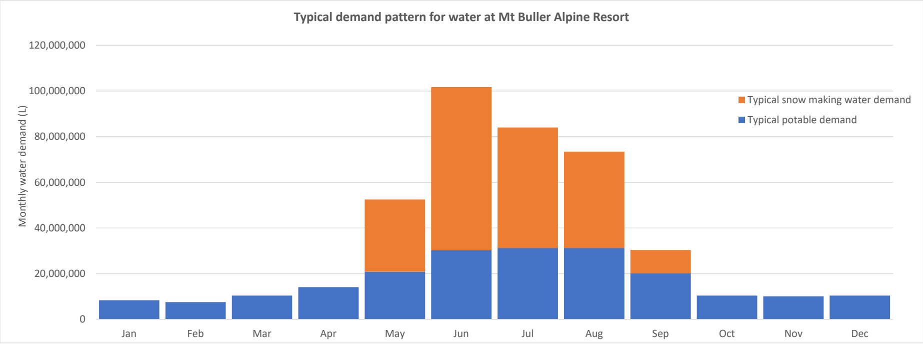


Figure 13. Average monthly water demand pattern

2.6 Water Balance

A water balance represents the average flow of water through a geographic area, and highlights the complexity of the different water uses, diversions, runoff relationships, and end uses of all sources and discharges of water.

For Mt Hotham Alpine Resort, the most important aspects of the water balance is the access to a diversion from the Swindlers Creek (a diversion licence of up to 175 ML / year for potable water), and another extraction from the weir downstream for snowmaking purposes. All snow melt ultimately returns to the river, in each valley across the resort. Wastewater is treated to Class A standard and pumped to Loch Dam for reuse in snowmaking or discharged to the Dargo River.

While it might appear that there is a lot of water falling on the resort (sometimes as snow), most of this water, on an average annual basis, is intercepted by the vegetation and evapotranspired.

Impervious runoff from the several car parks and natural snow melt are relatively large discharges from the resort, compared to wastewater.

The resort is not constrained in terms of access to the total annual take of raw water, but is constrained in terms of storage sizes, time of use, and weather conditions to support snowmaking.

The water balance was calculated using a variety of models and data points to create the best estimate of how much water is used or flows from each activity in the resort.

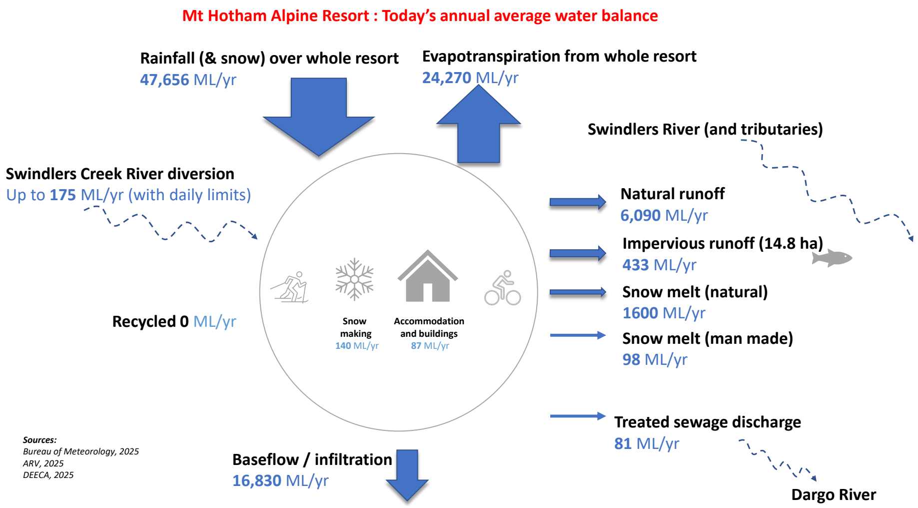


Figure 14. Water balance for the resort

2.7 Water stress and resilience

Water management in alpine areas is inherently complex, and having access to the appropriate amount of water, of the right quality, at the right time, to support a winter season, is a challenge.

The water balance in Figure 14 shows the overall volumes of water that flow in and out of the LGA, but it doesn't capture the degree of 'water stress' or the degree of reliability and uncertainty in supply water for potable use and snowmaking.

Swindlers Creek is the primary water source or potable water for the resort, and Swindlers Creek extractions are backed up by the water recycling plant for snowmaking. Access to water in the autumn months, in the lead up to the winter season, is when there is potential to have both a low supply and high demand scenario, and water stress and resilience is low and can impact on the beginning of the winter season.

Analysis of the Swindlers Creek flow series was undertaken to understand when the flows are below the minimum flow requirements and cannot be extracted. This shows that that there up to a 7% chance the daily flow being below the minimum flow requirement. If there is enough capacity to store water, and if the demand doesn't exceed 1.5 ML / day, or 10 ML / week, then the analysis below shows there is a 7% risk of water stress, if this is the only source of water. There are several other factors (like pumping infrastructure restrictions, ecological values downstream, and other losses) that need to be considered, but this provides some context to the nature of water stress and reliability.

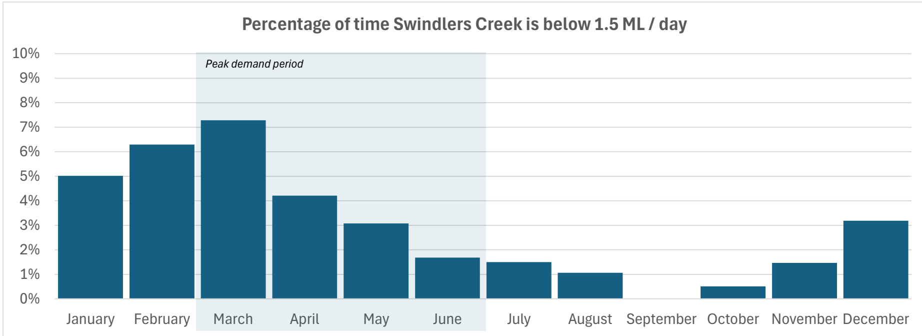


Figure 15. Percentage of flows that are below the 1.5 ML / day threshold at Swindlers Creek

2.8 Climate Context

Victoria's alpine resorts, including Mt Hotham, face significant challenges from climate change, which is altering key environmental and economic conditions. Over the past 70 years, snowfall has decreased, with the snow season now starting later and ending earlier. By 2070-2099 relative to 1961-1990, under a high emissions scenario (RCP8.5), snowfall decline at Mt Hotham is projected to be around 71%.[24]

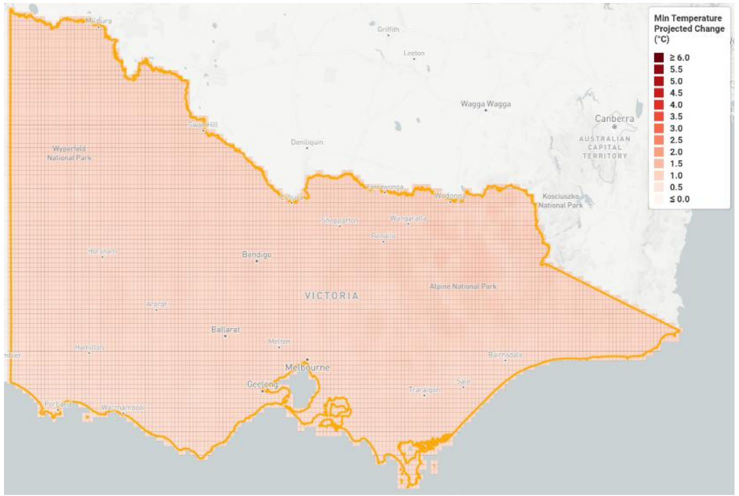
> "The businesses understand that they are here for a short time and hence need to manage with the long-term function of the ecosystem."
>
> *Workshop 1 participant*

Snowmaking technology will be critical for sustaining winter tourism, but its effectiveness depends on future water availability and energy costs. An overall decline in Spring rainfall by 22% in 2040-2059 under high emissions scenarios in the Ovens-Murray region may limit water supply for snowmaking.[25] Earlier snowmelt could also reduce water storage capacity, affecting both ski operations and environmental water flows. Also, whilst average rainfall may decline, projected changes in heavy rainfall events are mixed with large uncertainties; projections suggest a decline in daily rainfall intensity of up to 9% for events with a 20-year recurrence interval for a high emissions scenario but an increase of 3% for a medium emissions scenario.[26]

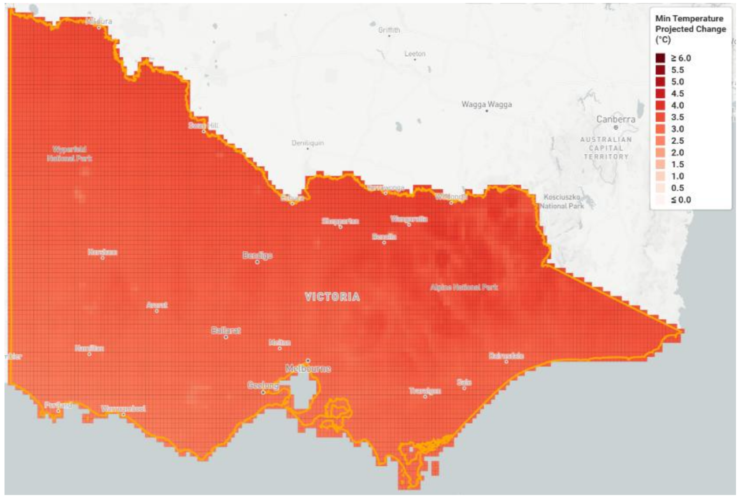
While average annual rainfall is expected to decrease in the ARV alpine regions, there is also indication that drought durations may see a slight decrease at Mount Hotham.[27] At the same time, average daily maximum temperatures for both summer and winter are projected to increase on the historic average. Minimum winter temperatures are modelled to increase at Mt Hotham by 1.6°C by 2050 under a high emissions scenario and summer average daily maximum temperatures are expected to increase by 2.6°C.[28] This warming accelerates snowmelt, shortens the snow season, reduces snowmaking efficiency, and increases bushfire risk.

The figures on the following page illustrate, with a focus on minimum and maximum temperatures, how the climate is forecast to change, often with more change in the alpine area than other areas of the state. A temperature increase of 5 or 6 degrees would significantly alter the snow coverage, depth and overall visitor experience.[29]

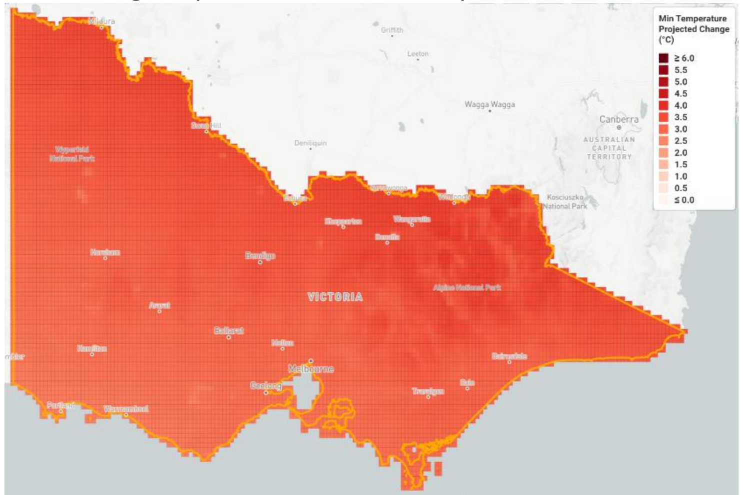
[24] Nation Partners (2024). *Summary of Climate Change Science and Impacts*. Prepared for Alpine Resorts Victoria. Version 3.0, 11 July 2024. Melbourne, VIC.
[25] Ibid.
[26] Ibid.
[27] Ibid.
[28] Ibid.
[29] Clarke JM, Grose M, Thatcher M, Hernaman V, Heady C, Round V, Rafter T, Trenham C & Wilson L., 2019. *Victorian Climate Projections 2019 Technical Report*. CSIRO, Melbourne Australia.



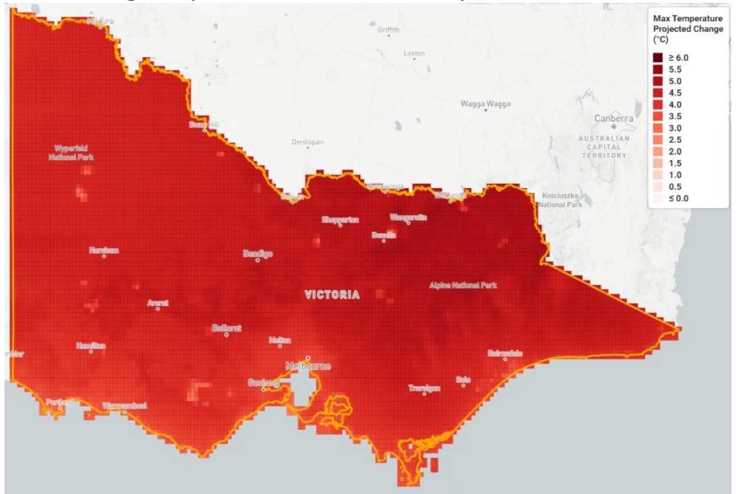
Climate change impact on minimum temperatures for 2020-2039



Climate change impact on maximum temperatures for 2020-2039



Climate change impact on minimum temperatures for 2080-2099



Climate change impact on maximum temperatures for 2080-2099

Figure 16. Climate change forecasts by DEECA / Victoria Climate Future Tool.

2.9 Managing Country

Gunaikurnai and Taungurung are Registered Aboriginal Parties (RAPs) under the Victorian Aboriginal Heritage Act (2006). Other Traditional Owners groups who identify connection with Mt Hotham Alpine Resort but do not currently have formal recognition under Victorian Law includes Dhudhuroa Waywurru Nations, Duduroa Dhargal, Jaithmathang TABOO and Jaithmathang TO.

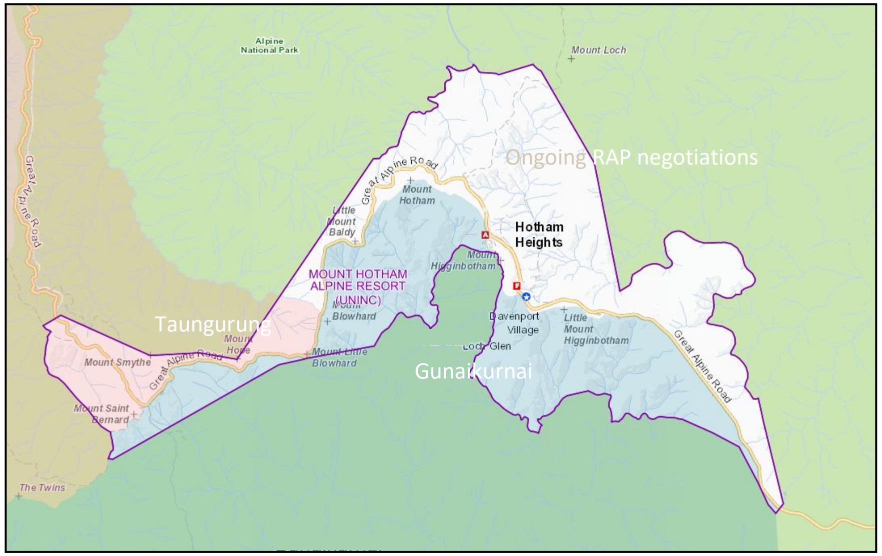


Figure 17. Registered Aboriginal Party (RAP) – Mt Hotham Alpine Resort. Image: Victorian Aboriginal Heritage Register and Information System (version 3.3.5.1 6, December 2024)

2.9.1 Gunaikurnai

The Gunaikurnai RAP area within Mt Hotham Alpine Resort includes the headwaters of the Wongungarra and Dargo Rivers (Mitchell River catchment) on the south side of the Alpine National Park southern ridge.

Plans and guidance prepared by GLaWAC and GKTOLMB[30, 31, 32] outline Gunaikurnai responsibilities and aspirations related to Country (including water). GLaWAC and GKTOLMB have also developed strategic plans to guide initiatives aligned with the Gunaikurnai Whole-of-Country Plan and are developing a water strategy.

2.9.2 Taungurung

The Taungurung RAP area within Mt Hotham Alpine Resort includes the headwaters of the Buckland River East Branch and Ovens River East Branch on the north side of the Alpine National Park southern ridge.

Taungurung responsibilities and aspirations related to Country (including water) are outlined in plans and guidance prepared by TLaWC.[33,34,35] TLaWC is also developing a Cultural Water Program that will include approaches for reading water country, assessing values, identifying important waterscapes and applying flow regimes to heal and strengthen cultural values.[35]

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[30] GLaWAC (2015). *Gunaikurnai Whole-of-Country Plan*.
[31] GKTOLMB (2018). *Gunaikurnai and Victorian Government Joint Management Plan*.
[32] GLaWAC (2022). *Gunaikurnai Nation Statement - Water is Life*.
[33] TLaWC (2016). *Taungurung buk dadbagi / Taungurung Country Plan*.
[34] TLaWC (2022). *Taungurung Nation Statement - Water is Life*.
[35] TLaWC (2023). *Taungurung Cultural Land Management Strategy*.

2.9.3 Other Traditional Owners

Dhudhuroa and Waywurru have expressed their sovereign rights to water, including management of significant sights and water systems, in their *Water is Life – Nation Statement*[36].

> *Our collective obligations and duty is to our sacred waterways, the land, the animals and plants, and all parts of the ecosystem and landscape.*[36]

Dhudhuroa, Waywurru and Ngurai Illum have an active Native Title Application with the Australian Federal Court (lodged in 2023) which includes all parts of Mt Hotham Alpine Resort outside the Gunaikurnai RAP area. Dhudhuroa Waywurru Nations Aboriginal Corporation (DWNAC) have been involved in various projects/partnerships with DEECA, Parks Victoria, North East Catchment Management Authority (NECMA) and North East Water.[37]

Dhuduroa and Dhargal water-related aspirations are expressed as a vision for water and country in their *Water is Life - Nation Statement*[38]:

> *Our vision [is for] future generations to enjoy healthy waterways which are thriving and rich in resources, with cultural heritage protected. Being the sovereign water holder and authority to manage water so that country and its people can thrive.*[38]

Duduroa Dhargal Aboriginal Corporation (DDAC) worked with Victorian Government departments and agencies on water and land management initiatives in 2022-23.[39]

Jaithmathang TABOO *Water is Life - Nation Statement*[40] outlines their philosophy and approach to engagement and partnership in relation to water access. This includes working with government agencies to build partnerships in managing country and water, while acknowledging the conflict between conservation and tourism/ development as a constraint to protecting and healing alpine country.

Jaithmathang TABOO and GLaWAC collaborated with North East Catchment Management Authority (NECMA) on a five-year Mountain Pigmy Possum recovery project (2019-2023) through the National Landcare Program. Jaithmathang TABOO also has connections with the Nallawilli Group of companies, including asset intelligence, land management, and workplace supplies businesses.

Jaithmathang Traditional Owners identify the inter-relationship between Jaithmathang people, culture and country in their *Water is Life – Nation Statement.*[41] This is expressed as:

> *maintaining our waterways and connections to water will determine the future of Jaithmathang culture*
>
> *how Jaithmathang knowledge and culture influences modern water management will determine the future of our waterways.*

Jaithmathang Traditional Owners identify that capacity building for the Jaithmathang Nation, including supporting and empowering more Jaithmathang people to move into land and water management roles on County is essential.

[36] DWNAC (2022). *Dhudhuroa Waywurru Nation Statement – Water is Life (Section B)*.
[37] DELWP (2019*). Traditional Owner objectives and outcomes: Compilation of contributions to Vicotria's water resource plans*.
[38] DDAC (2022). *Duduroa Dhargal Nation Statement – Water is Life (Section B).*
[39] Vic Catchments (2025). Vic Catchments North East Case Study (accessed January 2025).
[40] JTABOO (2022). *Jaithmathang TABOO Nation Statement – Water is Life (Section B)*.
[41] JTO (2022). *Jaithmathang TO Nation Statement – Water is Life (Section B)*.

2.10 Partnering with Traditional Owners and Building Cultural Competency

ARV has obligations and aspirations to:

- build organisational cultural competence to engage with Traditional Owner groups with rights and interests in alpine resorts (Registered Aboriginal Parties and Traditional Owner groups without formal recognition)
- support Aboriginal self-determination and partner with Traditional Owners in the planning and management of alpine resorts.

Integrated Water Management in North East Victoria[42] informs this IWM plan and contributes to building ARV's water-related cultural knowledge and competence. ARV is also engaging with Traditional Owners as part of the development of ARV's Traditional Owner Engagement and Self-Determination Strategy.

[42] Three Seeds (2025). *Integrated Water Management in North East Victoria's Alpine Region.*

3 Integrated Water Management Planning in an Alpine Environment

Integrated Water Management (IWM) is a collaborative approach to managing water resources that considers the interconnectedness of water systems, including supply, demand, wastewater, stormwater, and environmental flows. In alpine environments, IWM is particularly important due to the region's unique ecological, hydrological, and climatic characteristics. These areas are critical sources of freshwater for downstream communities and ecosystems, yet they face increasing pressures from climate change, seasonal variability, tourism, and development.

Effective IWM in alpine environments ensures sustainable water use, protects fragile ecosystems, and enhances the resilience of water systems against extreme weather events like droughts, fires, and floods. By integrating perspectives across stakeholders, IWM helps balance the needs of people, industry, and nature while preserving the alpine environment for future generations.

As discussed previously, the options for IWM management considered in this plan were sourced from conversations with ARV staff and stakeholders during the two workshops, as well as interviews and the site visit. The ideas and opportunities generated from this engagement were then analysed using available data and also were evaluated based on their alignment with ARV strategic objectives and IWM outcomes. This alignment is important as it addresses how each option supports ARV's organisational goals, as well as the broader outcomes IWM seeks to support.

Figure 18. IWM framework for alpine resorts

3.1 ARV Strategic Objectives, 2024 – 2027

Alpine Resorts Victoria (ARV) has six strategic objectives to guide activities between 2024 – 2027. These objectives were created to ensure ARV has clear direction to support sound decision-making. The alignment of these objectives with each individual IWM option will be discussed further later sections. The table below shows the connection between the ARV objectives and IWM planning.

ARV Strategic Objective	Relevance to IWM planning
Investment: Enable investment that drives sustainable businesses	Supports IWM through financing water infrastructure improvements and ensuring water-related services are resilient and sustainable
Environment: Protect and enhance the alpine environment and adapt to climate change	Reducing water use and improving water security mitigates environmental impacts on alpine ecosystems
Visitors: Enhance the visitor experience	Ensures water services meet visitor demand, maintaining quality and accessibility
Reform: Implement practical policy and regulatory reform	Facilitates the adoption of updated water management practices and regulations
Progress: Enhance organisational excellence and sustainability	Effective IWM planning depends on robust governance, resource allocation, and continuous improvements.
People: Build constructive culture and leadership capabilities	Developing expertise in IWM among ARV staff ensures long-term sustainability and informed decision-making.

3.2 IWM outcomes and relevance to Mt Hotham

There are generally eight strategic outcomes of an IWM approach; each outcome addresses a different aspect of the water system. However, it is important to recognise that most IWM plans (and outcomes) are focused on urban environments and communities that are quite different from a resort or alpine environment. The following table displays the IWM strategic outcomes and their relevance to Mt Hotham Alpine Resort.

System Aspect	Outcome	Relevance to Mt Hotham
Water sources	1. Safe, secure and affordable supplies in an uncertain future	Increase the amount of water conserved or alternative water volume supplied to meet demand.
Wastewater	2. Effective and affordable wastewater systems	Ensure environmental and public health standards are met while maximising resource recovery.
Drainage, stormwater, and flooding risks	3. Effective stormwater management to manage flood risks	Minimise environmental impacts of stormwater; ensure resilience to existing and future flood risks.
Waterways	4. Healthy and valued waterways and waterbodies	Improve ecological health of alpine bogs and riparian areas; improve hydrology and water quality.
Water in urban landscapes	5. Healthy and valued landscapes	Maximise the connectivity, accessibility, aesthetic, and recreational values of landscapes.
Traditional owners	6. Traditional Owner values, opportunities, and inclusion	Ensure that Traditional Owner values and priorities are acknowledged, respected, and enhanced.

System Aspect	Outcome	Relevance to Mt Hotham
Community value of water	7. Community values reflected in place-based planning	Ensure that different communities are considered and included in planning and design. Consider how to increase water systems literacy of resort visitors.
Economic values	8. Jobs, economic opportunity and innovation	Recognition that water management is an integral part of sustainable business

3.3 Traditional Owner Considerations

As an interim step toward understanding and respecting Traditional Owner values of alpine water systems in North East Victoria, cultural considerations are identified below. These are based on documented cultural knowledge, aspirations and land management principles of Traditional Owners groups that identify connection with Mt Hotham Alpine Resort. Engagement with Traditional Owners through the development of ARV's Traditional Owner Engagement and Self-Determination Strategy and/or implementation of this IWM Plan may provide opportunities to review and refine these cultural considerations and associated IWM options.

Figure 19. Cultural considerations for alpine resort water planning.

1. **Respect First Peoples connection to Country**
   Alpine areas are culturally significant to First Peoples

   IWM Consideration: Recognise and respect First Peoples connection to Country. Understand that formal recognition of First Peoples rights is ongoing.

2. **Manage water as part of cultural landscape**
   Water is part of a cultural landscape; everything is connected

   IWM Considerations: Understand and address potential adverse impacts of water management decisions on the cultural landscape within and beyond alpine resorts.

3. **Support cultural land management initiatives**
   Work together to care for Country

   IWM Consideration: Identify opportunities to support Traditional Owner cultural land management goals and aspirations through alpine water planning and management.

4 Water Management Options

The options presented in this plan have been grouped into four categories.

- **Good water management**. These set of options relate to good asset management and sound management of water as a precious resource, that also should be pursued irrespective of the long-term strategic plan for the resort. They include partnerships and understanding with the traditional owners, and there is better reporting on water consumption, savings, end uses and discharges, for an overall increased water efficiency resort.
- **Environmental values**. These set of options relate to the impact of surface water systems on the downstream and surrounding environment. Options specific to reducing the impact of stormwater from the impervious surfaces (in particular the car parks in and around the resort) are critical to these options. The options relate to reducing diffuse source pollution, and erosion, and in some instance wastewater discharges on the environment.
- **Integrated water and energy strategy**. Energy and water are both significant issues in running the alpine resorts, and options that relate to increasing the opportunities for renewable energy production through the smart use of water storages and water discharges are noted in these set of options.
- **Future water resilience**. These options relate to augmentation of the water supply, storage and infrastructure system that support moves to creating a more resilient water system that can cope with climate change and forecast visitation at the resort.

The options under these themes are shown in Figure 20.

4.1 Refining options based on stakeholder feedback

Figure 20 lists twenty-one diverse IWM options. A useful IWM plan is one that is clear and prioritises action and investment in a few key areas that will support IWM and the resort's vision, rather than a long list of options.

To refine the twenty-one options and leverage stakeholder expertise, the project conducted multiple iterations to stress test feasibility and support levels. Two workshops, attended largely by the same representatives, played a key role in this process. In particular, the second workshop provided an opportunity for ARV staff and stakeholders to critique and refine options (see Appendix B). Through this process, some options were deemed infeasible, while others were refined or improved based on stakeholder insights.

This resulted in a priority set of 16 options deemed worthy of additional review and modelling. Of the 16, one of the options (new diversion in the Diamantina River from northern catchments) did not pass the technical feasibility task and is not included in the action plan. Also, of the 16 options, eight of these are in the 'good water management' category, which were agreed to be reasonable actions to do at the resort, irrespective of the longer-term vision and operation of the resort.

To further expand on some of the reasoning and issues that were discussed in the workshops, Figure 21 captures how far each option got in terms of meeting various criteria that was raised and discussed in the workshops.

> "Practical issues with storage and freezing of water will make solutions like rainwater harvesting less viable."
>
> *Workshop 2 participant*

Good water management

- **Option 1A: Increase understanding of Gunaikurnai and Taungurung cultural values**
- **Option 1B: Consider water-related opportunities**
- **Option 1C: Introduce water metering**
- **Option 1D: Systematic approach to leak detection for potable and snowmaking**
- **Option 1E: Water efficiency measures and automation**
- **Option 1F: Water efficiency of snow making infrastructure**
- **Option 1G: Maintenance**
- **Option 1H: IWM reporting**

Stormwater and environment

- **2A: Stormwater and erosion protection**
- 2B: Car parks, stormwater and assets protection

Energy and water

- 3A: Mini hydro with existing infrastructure
- 3B: Pumped hydro

Future water resilience

- **Option 4A: Additional storage reservoir**
- **Option 4B: New diversion on northern catchments**
- **Option 4C: Formalise 3rd diversion and pump (Swindlers)**
- Option 4D: Additional infrastructure
- **Option 4E: Rainwater harvesting**
- **Option 4F: Groundwater licensing, extraction and use**
- **Option 4G: Stormwater harvesting**
- Option 4H: Snow melt harvesting
- **Option 4I: Covering of storage ponds**

Figure 20. List of all IWM options

Note the items in bold were supported for further investigation and inclusion in the plan by stakeholders.

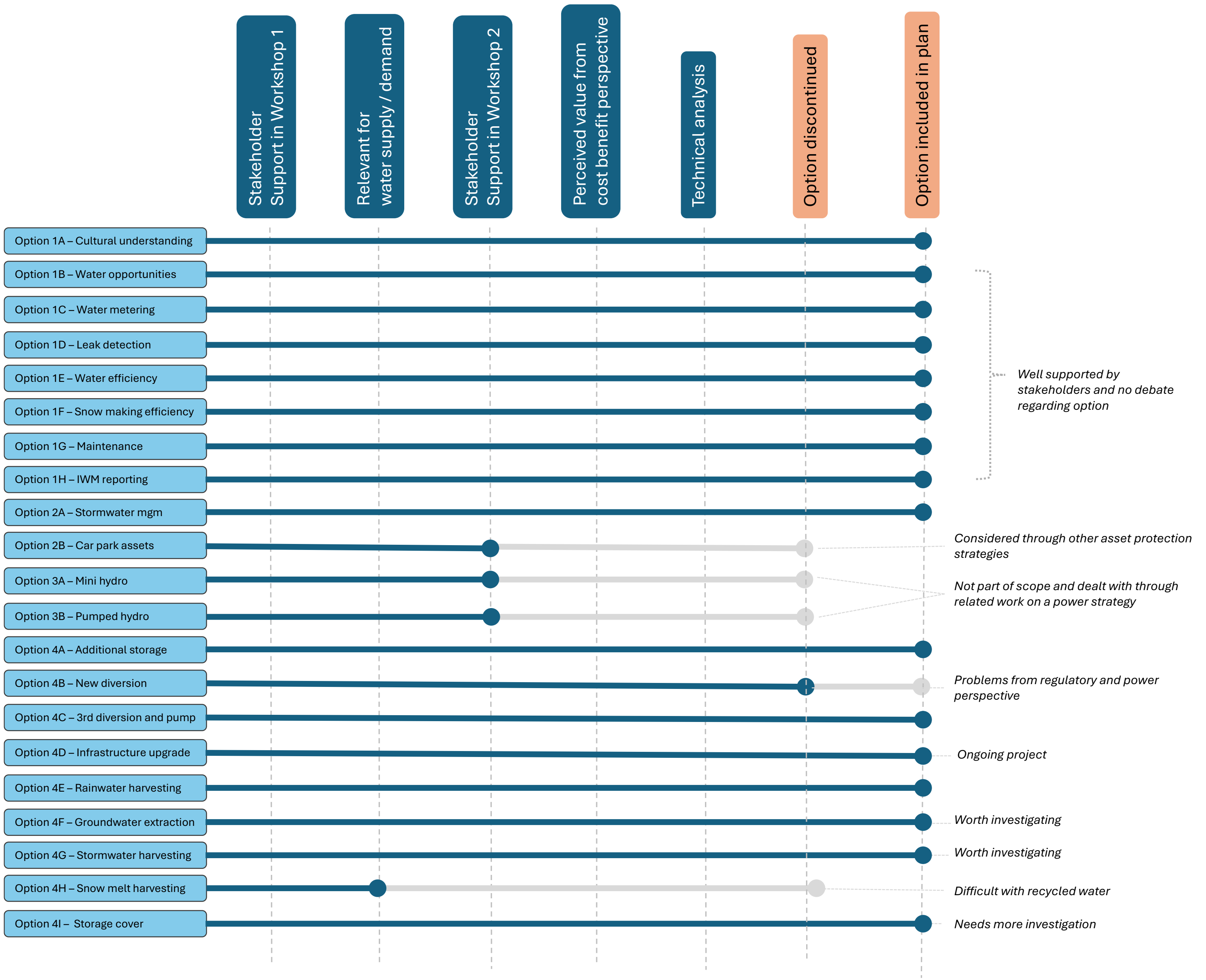


Figure 21. Summary of support for options

5 Options analysis

5.1 Description of options

The subsequent pages present the modelled options for Mt Hotham, as well as identify beneficiaries, costs, uncertainties, and risks. There are also several options recommended for Mt Hotham (discussed in Section 6) that were unable to be modelled due to lack of available data.

5.2 Modelling method

A custom model was built to model, at an hourly time step, over 10 years, every demand for water, the fluctuations in storages and diversions, and the water demand of snowmaking and melting. Weather, rainfall, visitation, GIS data, and snowmaking data was used to calibrate the model. Options could be then tested against the base case operations.

To assess water options, the following assumptions were made:

- The resort uses in total 227 ML / year of water (87ML / year of potable water for the buildings and operations, and 140 ML / year of water for the snowmaking.)
- The resort uses snowmaking Mother Johnson's Return, Milky Way, Upper and Lower Imagine, Blue Snake, Snake Gully, The Canyon, and The Summit, a total area of 380,000 m^2.
- Snowmaking requires 500 L / cubic metre of snow.
- Water is diverted from the Swindlers River Weir #2 to Loch Dam, noting the extraction point for pumping is downstream of the potable diversion point.
- The diversion for potable water has an upstream area of 178 hectares (all forested).
- Modelling of rainwater patterns was based on the rainfall records at Hotham, with daily and sub daily rainfall data.
- Mean annual rainfall for the period used in the modelling, from the Hotham rainfall gauge, is 1,633 mm / year.
- Hourly temperature, humidity, and wind data for Hotham was used to model snowmaking conditions, as the closest station with hourly data, and provides a good basis to identify appropriate weather conditions for snowmaking, and melting.
- Snowmaking was modelled to occur every time the wet bulb temperature is less than '-2 degrees'.
- It is assumed that up to 125 cm of snow would be made if the weather were conducive, there was available water, and the volume of water did not exceed the pump capacity, in the peak of winter.
- Snow melt was modelled using a 'degree days' function, which varies with temperature (i.e. a higher Degree Days Factor for a higher temperature). The following function was used to determine the melting factor (and applied every time step): $y = 0.2415 e^{.1004 x}$ (where y = cm of snow melt, and x = temperature).[43]

[43] Muhammad Fraz Ismail, H.-u.-R. W. (2015). *Degree day factor models for forecasting the snowmelt runoff for Naran watershed*. Science International Lahore, 1951-1959.

The figure below highlights the downward trend in available weather windows that are suitable for snowmaking, with snow guns. This changing climate has implications for the need to use more water in a shorter period of time, which is explored in the options below.

It should be noted that there are a variety of factors that influence the optimum time and period to run the snow guns, which are not all represented in the figure below. This figure is indicative of how a warming climate changes the number of hours where the temperature, humidity, wind speed and wet bulb are appropriate for snowmaking (the dark blue colour on the chart), and there is less opportunity to create a snow pack that coincides with the visitation patterns and holidays.

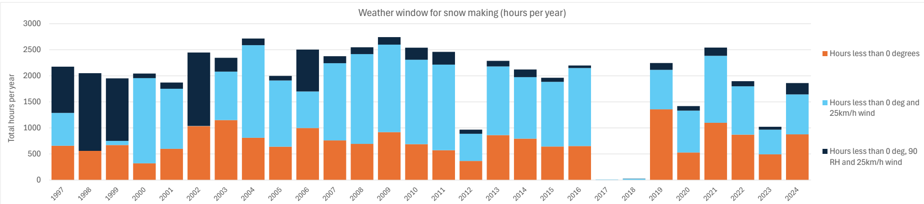


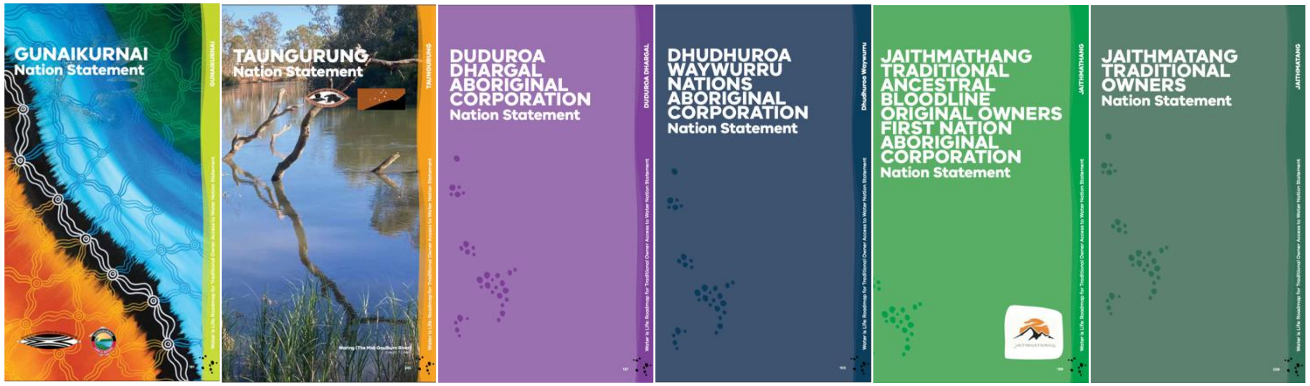
Figure 22. Bureau of Meteorology's Hotham weather station history from 2004 to 2023.

5.3 Options detail

5.3.1 Option 1A: Increase understanding of Traditional Owner cultural values

This option supports broader and deeper understanding of Traditional Owner cultural values of water in alpine landscapes, including connections to Country via headwater streams of the Ovens, Kiewa, Mitta Mitta and Mitchell Rivers. Initiatives should:

- focus on building the cultural awareness and competence of resort staff and visitors,
- align with ARV's Traditional Owner Engagement and Self-Determination Strategy (in-development), and
- where possible, be developed and delivered in partnership with Traditional Owner groups that identify connection with Mt Hotham Alpine Resort based on their self-determined priorities and capacity.



Risks / Uncertainties:

- Traditional Owner involvement will be self-determined, informed by their priorities and capacity.

Summary:

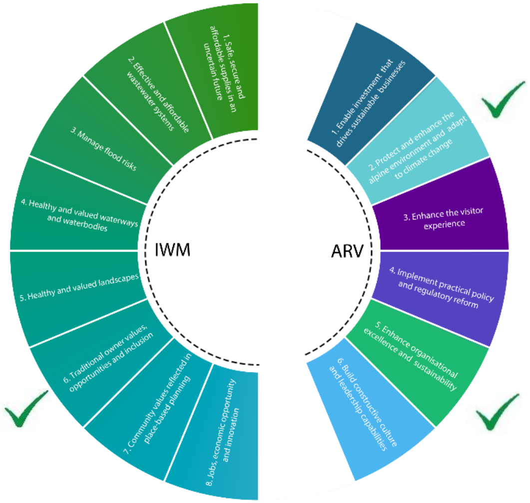
Greater awareness of cultural values of water in alpine landscapes supports ARV obligations and aspirations to work in partnership with Traditional Custodians.

Category: Good Water Management

Who benefits: ARV, resort visitors.

Costs: To be determined (dependent on the scope of specific initiatives and level of involvement)

Alignment with IWM Outcomes and ARV Objectives:



5.3.2 Option 1B: Two-way knowledge sharing

This option is focused on identifying potential water-related opportunities for resort stakeholders and Traditional Owner groups to partner on social, cultural and/or economic activities that support two-way knowledge sharing. Specific initiatives should:

- build on existing relationships between Traditional Owner groups and other government agencies, and
- align with ARV's Traditional Owner Engagement and Self-Determination Strategy (in-development).

Initiatives could include, for example, resort-based events, ecological monitoring of alpine ecosystem values, environmental/biodiversity management, and cultural celebrations.

Risks / Uncertainties:

- Traditional Owner involvement will be self-determined, informed by their priorities and capacity which may vary over the life of this plan.
- Identification of specific initiatives was not possible at the time this plan was prepared.

Summary:
Working with Traditional Owner groups on two-way knowledge sharing initiatives supports ARV obligations and aspirations to work in partnership with Traditional Custodians.

Category: Good Water Management

Who benefits: ARV, resort stakeholders, Traditional Owner groups.

Costs: To be determined (dependent on specific initiatives).

Alignment with IWM Outcomes and ARV Objectives:

5.3.3 Option 2A: Stormwater and erosion management

Stormwater runoff from car parks impact downstream environments through stormwater pollution and erosion. These impacts can be mitigated through the re-design/upgrade of car park edges, for example, by:

(1) introducing diversions, vegetation, rock protection and berms to manage runoff on slopes below the car park, and/or

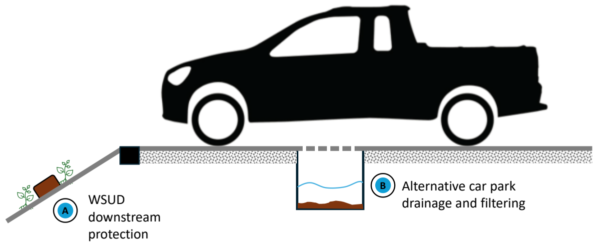
(2) installing a strip trench and grate system set two meters back from the edge (to allowing snow clearing) while capturing and filtering stormwater pollutants through a sump pit and sand filter.

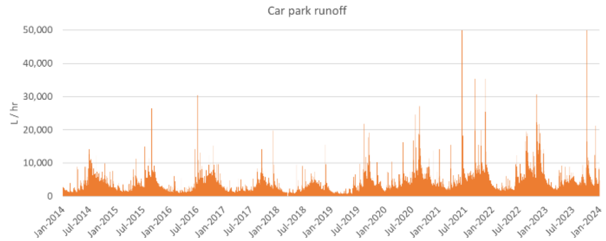
This option will make a major contribution to the improved management of stormwater and support ARV's approach to protecting alpine environmental values.

Category: Environmental values

Who benefits: Downstream environment, Traditional Owners

Costs: Variable and dependent on length of car park edge





Road surface (Hotplate Drive)

Runoff from 3.4 ha of impervious surfaces including car parks generates significant stormwater, leading to erosion, asset damage, and pollution. Managing this pollution is challenging in the alpine environment due to snow, salt use for snow management, and graders clearing snow and debris.

Alignment with IWM Outcomes and ARV Objectives:

Risks / Uncertainties:

- Potential impacts of car park stormwater management on current snow clearing processes will need to be considered as part of further investigation/design.
- Maintenance of proposed trench drains (process and frequency) will need to be considered as part of further investigation/design.

Summary:

Innovative options are required to reduce the risk of stormwater pollution and erosion, and if successful. consider how to explore stormwater harvesting options. This option requires long term change to asset management and design of car parks.

Use of nature based solutions should be considered in the context of how to manage snow accumulation on car parks.

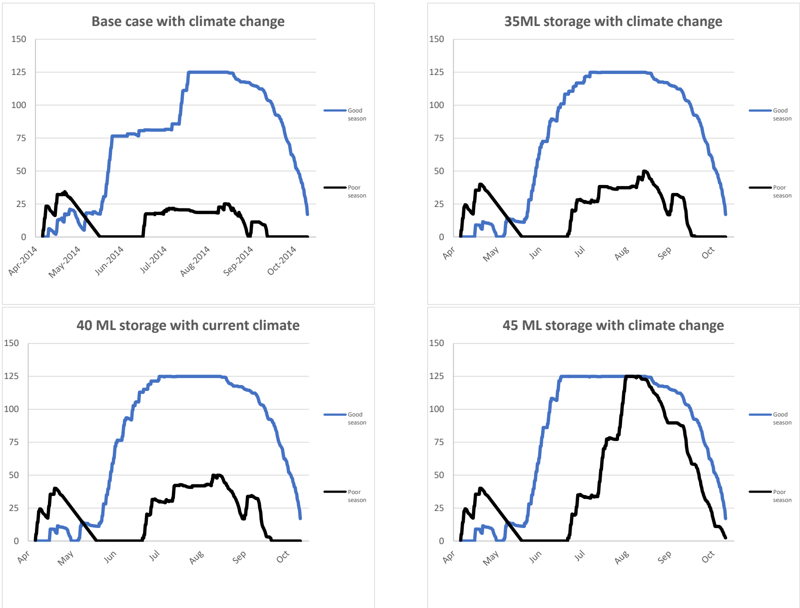
5.3.4 Option 4A: Increase snowmaking storage capacity

This option evaluates the impact of increasing / augmenting the capacity of the Loch Dam from 28ML to between 35ML and 45 ML to increase water available for snowmaking. Additional water supply would be obtained from either Swindlers Creek Weir #3 or stormwater harvesting (see Option 4G), subject to licence conditions and water availability / reliability. The option is based on snow being produced for 38 hectares and suitable snowmaking conditions occurring 50 % less than the average for the past 10 years. Currently, flow in Swindlers Creek is lower than the allowable rate for diversion 3-7% of the time (see Figure 15 in Section 2.7) and is expected to become less reliable as the climate continues to change.

Category: Future water resilience

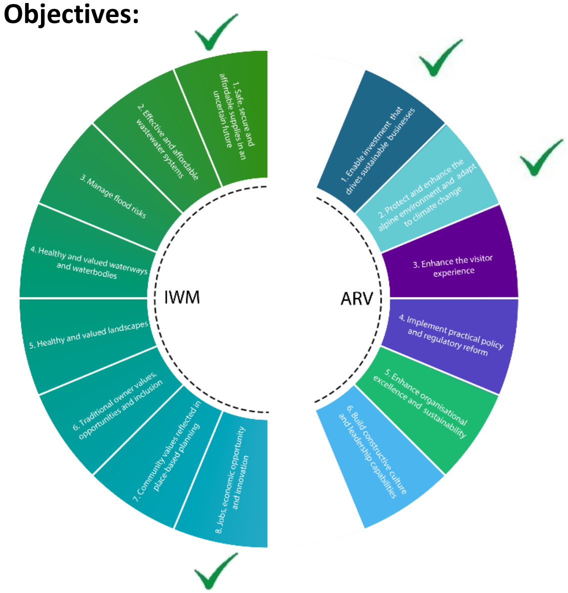
Who benefits: ARV, Vail Resorts and visitors

Costs: Dependent on feasibility work. $50k to 100k for business case and concept design



Modelling shows that the impact of increased water storage for snowmaking is low for seasons with average natural snowfall and weather conditions (blue line). Increased storage for snowmaking would enable greater snow production in seasons with low natural snow cover and warmer weather (black line).

Alignment with IWM Outcomes and ARV Objectives:



Risks / Uncertainties:

- Availability / reliability of supply (from Swindlers Creek or stormwater harvesting).
- Viability of an expanded/new storage, including ecological considerations, constructability, costs, etc.
- Integration with existing treatment and pump systems.
- High degree of risk of having an adverse environmental impact with increased extraction.

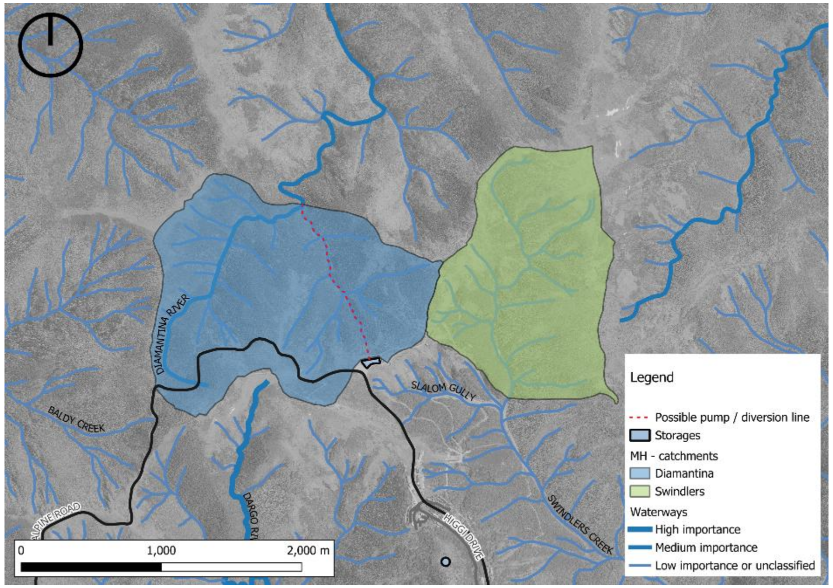
Summary:

A 5-15ML increase in water storage capacity for snowmaking could support greater snow production in seasons with low natural snow providing water diversion or stormwater harvesting can provide an additional ~25% water supply. A hybrid approach with snow factories will have impacts on energy consumption as well.

A feasibility study would be required to determine the viability / suitability of this option. **This option is not supported by all stakeholders.**

5.3.5 Option 4B: New diversion on northern catchments

An additional diversion from a northern catchment could supplement potable supplies and reduce reliance on water from Swindlers Creek. A feasibility assessment (including regulatory, ecological, cultural and technical) would be required. This option investigates the potential water supply from an extraction point in the upper Diamantina River. This would require a new diversion and pumping station and, based on the indicative water extraction point identified below, a 1,280 metre pipe with 300m lift to Loch Dam. With a catchment area of 240 hectares (compared to 178 hectares for Swindlers Creek Weir #1) this option could potentially provide up to 175 ML / year of additional water for snowmaking.



Risks / Uncertainties:

- Obtaining a water allocation / diversion licence.
- Impacts on cultural and ecological values.
- Lack of hydrology / flow data.
- High degree of risk of having an adverse environmental impact with increased extraction.

Summary:

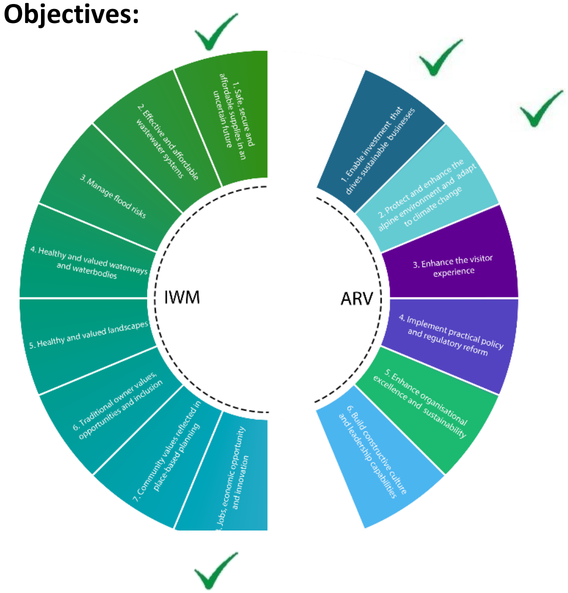
A new stream diversion on the upper Diamantina River has the potential to provide up to 175 ML / year of additional water for snowmaking. However, ecological and cultural considerations, approvals and infrastructure requirements make this a highly uncertain / high risk option. **Stakeholders did not support this option due to the uncertainties and the likely environmental and cultural impacts.**

Category: Future water resilience

Who benefits: ARV and visitors

Costs: n/a (option not recommended)

Alignment with IWM Outcomes and ARV Objectives:

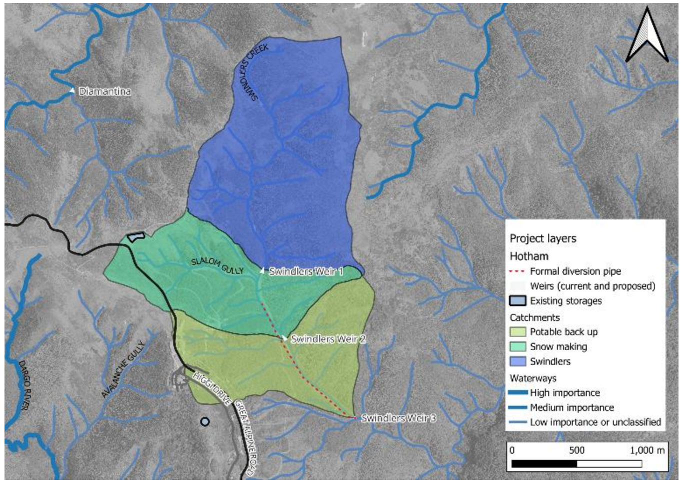


5.3.6 Option 4C: Formalise 3rd Diversion and Pump (Swindlers)

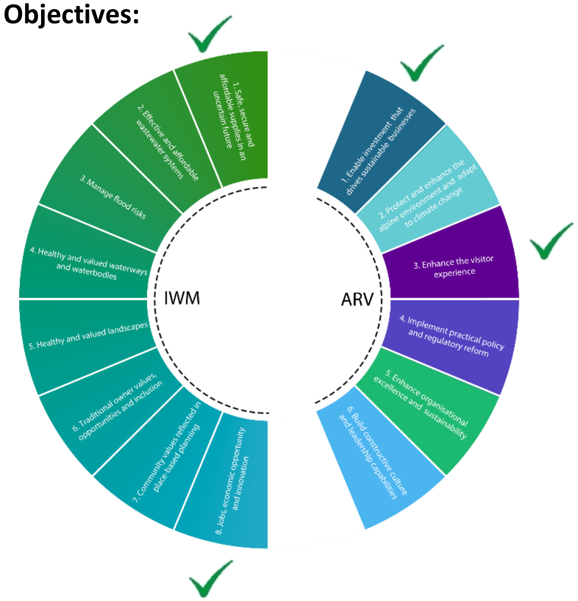
This option considers formalisation of water extraction from Swindlers Creek downstream of Weir #2 at the bottom of Blue Ribbon run. The catchment area at this location is 33% larger than at Swindlers Creek Weir #2 with a corresponding increase in potential water availability of approximately 30 ML per year (assuming the existing licence allocation could be increased), to include this extraction site. Extracted water could be pumped to the existing pumping station near Swindlers Creek Weir #1 for delivery to the Mt Higginbotham raw water tanks.

Category: Future water resilience
Who benefits: Visitors, ARV (reliability of potable water system)

Costs: $500,000+ (weir, pump and 1160 m pipe)



Alignment with IWM Outcomes and ARV Objectives:



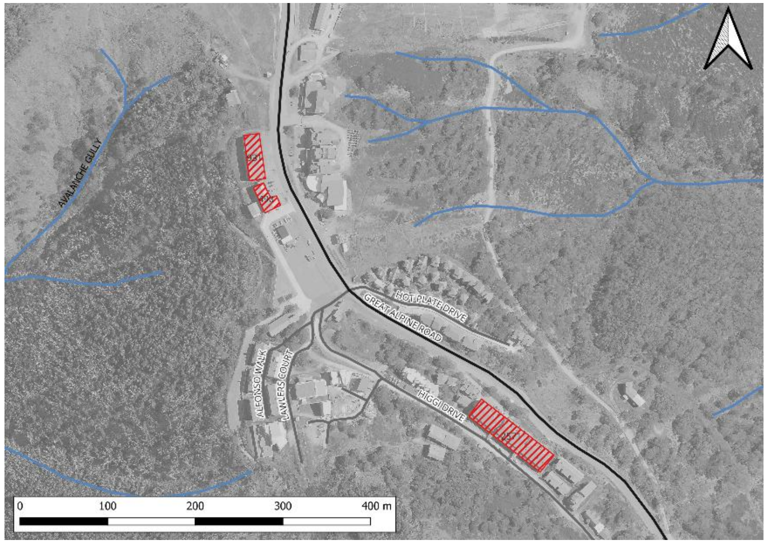
Risks / Uncertainties:

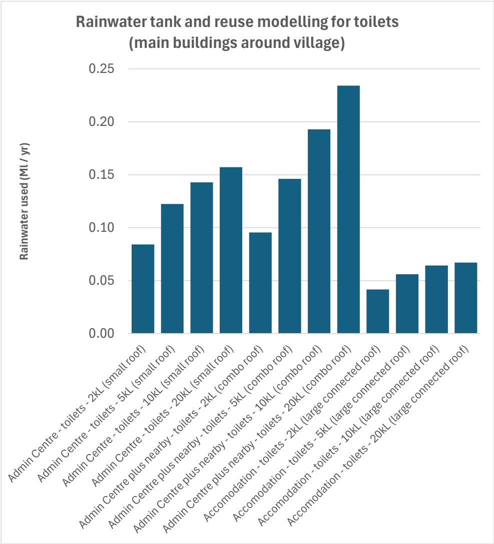
- Ability for the existing extraction / diversion licence to be revised.
- Impacts of additional water extraction on environmental flows.
- Impacts of weir construction / access on the waterway and associated ecosystem.

Summary:
This option may improve water reliability for firefighting and snowmaking.
It is assumed this extraction would require a new or modified licence (or little benefit if operating under the same licence). Assumes it would also have a similar daily extraction limit to the existing licence.

5.3.7 Option 4E: Rainwater harvesting

With this option, there could be various configurations of rainwater harvesting from one or more buildings to supply toilet flushing. Buildings could be retrofitted with gutters that capture rainwater while not being damaged by snowpack shedding from roofs (as used at Mt Stirling). Potential sites with large rood area are identified in the figure below: Snowbird Inn (930 m^2), ARV / Ski Patrol (500 m^2) and Arlberg Mt Hotham (2,500 m^2).





Category: Future water resilience

Who benefits: ARV, accommodation visitors, waterways.

Costs: Depends on size; 75% of cost relates to guttering and plumbing.

Alignment with IWM Outcomes and ARV Objectives:

Risks / Uncertainties:

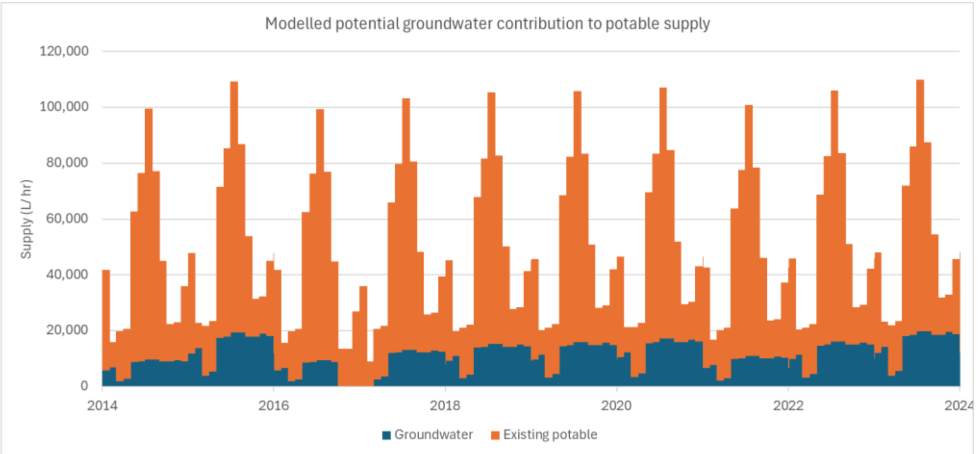
- Confirming roof design and gutters appropriate for alpine context (see Mt Stirling example).
- Location of storage tanks and associated infrastructure should avoid impacting native vegetation and the natural environment.
- Plumbing would need to be insulated to prevent water in pipes from freezing.

Summary:
Rainwater harvested from an individual building and used for toilet flushing has the potential to reduce potable water demand by approximately 0.1 ML / year. If scaled-up over time across multiple buildings, rainwater harvesting has the potential to reduce potable demands (extracted from Swindlers Creek) by up to 15%.
System design, operation and maintenance would need to reflect alpine context.

5.3.8 Option 4F: Groundwater licensing, extraction, and use

Groundwater is a potential alternate water source to supplement potable supplies and reduce reliance on water from Swindlers Creek. This option requires further investigation, including geological conditions, surface water – groundwater interactions (and implications for alpine wetlands in a changing climate), ecological and cultural considerations, and regulatory requirements.

Modelling was undertaken to explore the theoretical contribution of groundwater to existing potable water supplies. Assumptions included an average flow rate of 6 L / sec (with a ±30% variability as per rainfall) and a 90-95% reliability (assuming water quality issues take the system offline for 5% to 10% of the time). Based on these assumptions, groundwater could potentially supply up to 40% (approximately 35 ML / year) of current potable water demand and could also be used top up snowmaking storages.



Risks / Uncertainties:

- Groundwater availability, quality and reliability (DEECA's groundwater report[44] states for this location there is fractured rock and unknown salinity).
- Hydro-ecological and cultural implications.
- Licence approvals and conditions.
- Integrating groundwater into the existing treatment system.

Summary:

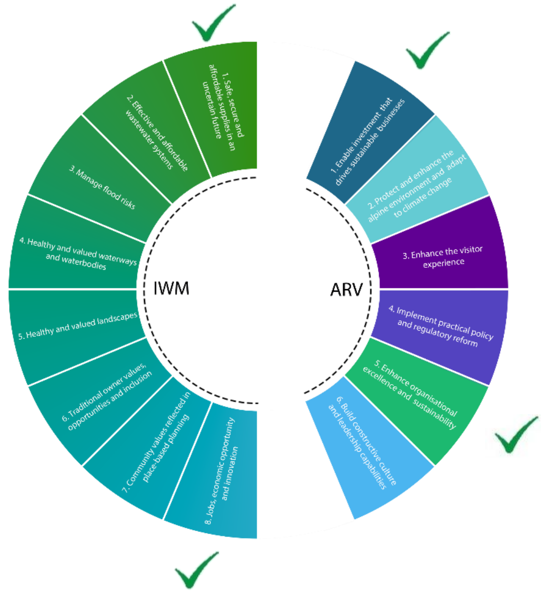
This option could theoretically augment existing water supplies and reduce reliance on surface water. Practical feasibility depends on local geological conditions and regulatory, ecological and cultural considerations which require further investigation. **This option is not supported by some stakeholders.**

Category: Future water resilience

Who benefits: ARV resort; environment (reduced surface water extraction but also reduced connection with groundwater so also a cost).

Costs: Dependent on feasibility work. $50k to 100k for business case and concept design.

Alignment with IWM Outcomes and ARV Objectives:



[44] Department of Environment, Land, Water & Planning, 2025. Groundwater Resource Report for VICGRID94 Easting: 2690756 Northing: 2499005

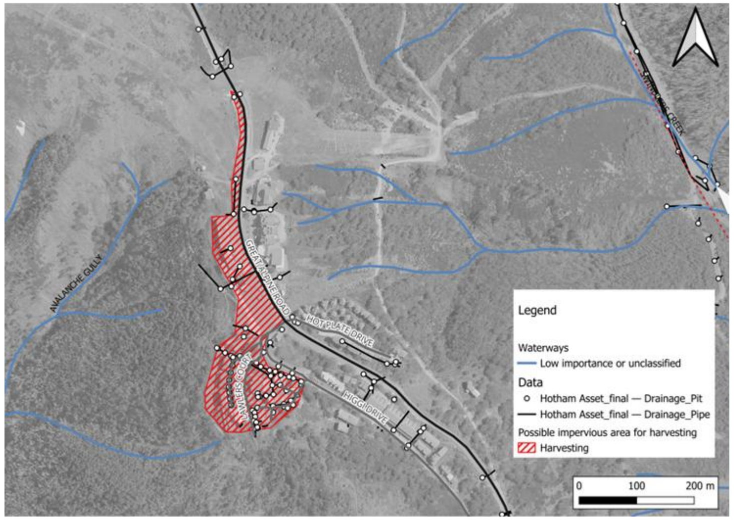
5.3.9 Option 4G: Stormwater harvesting

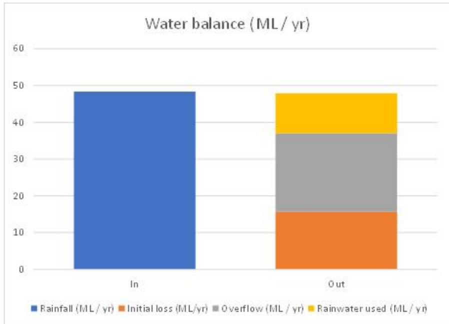
A 3.4 hectare area of roads and roofs were modelled to consider the potential for stormwater to be harvested, filtered and stored in Loch Dam. Further investigation to determine the quality of filtered stormwater and its suitability for snowmaking, infrastructure requirements and potential ecological impacts is required. Modelling indicates that harvesting stormwater between March and August (accounting for high losses due to snowpack) could potentially provide 10 ML / year based on the existing capacity of Loch Dam. With additional storage capacity (see Option 4A), 20 to 35 ML / year of stormwater could potentially be harvested.

Category: Future water resilience

Who benefits: ARV resort (snowmaking reliability and capacity); environment (reduced runoff and pollution)

Costs: Dependent on feasibility work. $50k to 100k for business case and design, but capital projects would exceed $1m.





March	April	May	June	July	August
100%	72%	50%	98%	23%	100%
100%	95%	73%	21%	32%	100%
100%	54%	95%	87%	57%	100%
100%	95%	25%	8%	68%	100%
100%	68%	7%	39%	26%	100%
100%	47%	9%	0%	0%	94%
100%	93%	21%	100%	89%	77%
100%	43%	33%	54%	100%	100%
100%	80%	30%	47%	21%	100%
100%	92%	18%	98%	94%	100%

Alignment with IWM Outcomes and ARV Objectives:

Risks / Uncertainties:

- Infrastructure to collect, filter, and then pump to Loch Dam is complex, with limited to no space.
- Flow variability.
- Asset maintenance requirements (particularly for any infrastructure located downslope from the resort / stormwater outlets).

Summary:

10ML /yr of stormwater from impervious or more could potentially be harvested, filtered and stored in Loch Dam. However, further investigation is required to understand risks and uncertainties, and to assess feasibility.
Large potential to deliver environmental benefit with harvesting and filtering of stormwater, but also offset by the impact of new infrastructure.

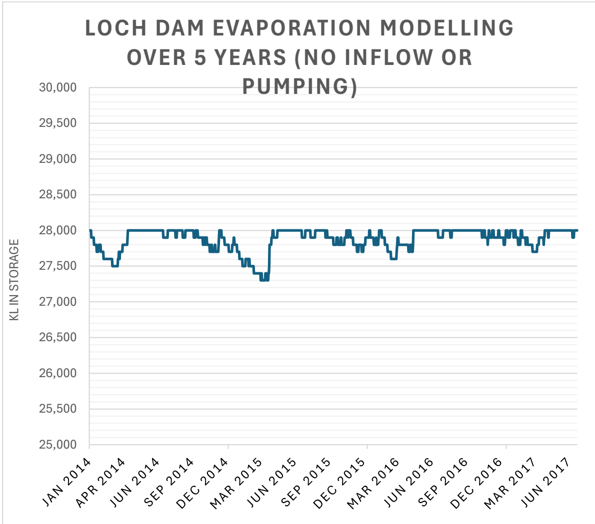
5.3.10 Option 4L: Covering of Storage Ponds

A cover over Loch Dam would reduce surface evaporation. A simplified model was used to estimate evaporation losses over a 5 year period for a 28 ML water storage at this location and elevation. Using evapotranspiration values from BOM, assuming rainfall as the only inflow to Loch Dam (i.e. excluding treated wastewater inputs) and no water extraction, average losses were estimated to be 1 ML / year.
A field trial to determine actual evaporation rates is recommended to confirm potential benefits. Selection of a cover type appropriate for alpine environments is an important consideration, as is the ability to remove the cover over winter to reduce maintenance requirements and avoid snow impacts. The use of plastic balls (see below – not recommended for Mt Hotham) illustrates one of many cover options available.

Category: Future water resilience

Who benefits: ARV, resort visitors (water savings from reduced evaporation, increasing water resilience and availability for snowmaking and potable consumption)

Costs: $250k based on past ARV experience.



Alignment with IWM Outcomes and ARV Objectives:

Risks / Uncertainties:

- Maintaining integrity of the cover in an alpine environment.
- Potential impact on water quality through reduced UV and leaching of cover material into water.
- Ability to remove over winter
- Costs (variable depending on size and method).

Summary:
Up to 1 ML / year of water could be saved if all evaporation is reduced. Various cover types should be considered. It is also possible to only use the cover in summer.

6 Recommendations

A suite of water management options for Mt Hotham have been identified and developed through engagement and analysis. Recommendations for progressing these options, including additional analysis / assessment to ensure there is a sound business case for investment, are included below. Options that were identified as not being viable are also listed. Options presented below but not shown in Section 5.3 were unable to be modelled due to lack of available data.

6.1 Recommended

These options collectively contribute to ARV objectives and IWM outcomes. Options are grouped by IWM category.

Good Water Management

- **# 1. Traditional Owner understanding and knowledge sharing** [Options 1A and 1B]
  Continue developing relationships with Traditional Owners focused on building understanding of cultural values of water at Mt Hotham and identifying longer term opportunities for knowledge sharing / working together.
- **#2. Water metering and leak detection** [Option 1C and 1D]
  Progressively introduce water metering and leak detection across the resort to support long-term management of all water resources and to reduce or delay future supply augmentation projects. This includes metering potable water consumption in all accommodation, meal / bistro, and administration and workshop buildings, and systemic leak detection and reporting to identify and address leaks, over a one to three year period.
- **#3. Water efficiency measures** [Option 1E and 1F]
  Introduce water efficiency and automation measures to reduce water use in buildings and across the snowmaking network. This includes upgrading all showers and toilets to/near maximum WELS rating , installing timers on all taps, and ongoing automation of snowmaking infrastructure. This also supports other options (e.g. rainwater harvesting) by reducing demands.
- **#4. Maintenance** [Option 1G]
  A quarterly inspection and maintenance schedule should be established for all core water infrastructure. This includes the regular review of tanks, pipes, and drainage lines to identify and resolve issues such as blockages and algal build-up. All maintenance activities should be logged and evaluated to ensure system integrity and guide future maintenance planning.
- **#5. IWM reporting** [Option 1H]
  Starting in 2026, an annual integrated water management report should be prepared to document the resort's water balance and action as it aligns to the eight IWM outcomes. This report should include metrics on total and per visitor water consumption, snowmaking usage, wastewater discharge, rainfall, rainwater harvesting volumes, modelled stormwater flows and pollutants, and observed environmental impacts such as erosion. The report will support greater awareness of water conservation and the finite nature of water resources in alpine environments.

Environmental Management

- **#6. Stormwater and erosion management** [Option 2A]
  Trial water retention / filtering systems to confirm practical ways of reducing the impacts of stormwater (particularly from car parks and roads) on the alpine environment. Water retention / filtering systems should reduce the volume and velocity of stormwater (and associated

debris) flowing into Swindlers Creek and Avalanche Gully, and reduce erosion in formal and informal drainage lines.

Future Water Resilience

- **#7. Additional storage reservoir** [Option 4A]
  A feasibility study should be commissioned to explore the expansion of Loch Dam's storage capacity to enhance the reliability of snowmaking during warmer seasons. The study should include hydrological modelling, environmental assessments, and infrastructure design options suitable for alpine conditions.
- **#8. Formalise 3rd diversion and pump** [Option 4C]
  Investigate the formalisation of water extraction on Swindler Creek near the base of the Blue Ribbon run to augment potable water supply or water for snowmaking, and confirm the need for a new licence verses the transfer / reuse of the existing licence. Power implications from this extraction should be included in the investigation.
- **#9. Rainwater harvesting** [Option 4E]
  Retrofit rainwater harvesting for toilet flushing (and potentially summer irrigation) at one of the buildings identified in Section 0. with a 10 kL to 20 kL rainwater tank. Monitor and evaluate the system to determine the reduction in potable water use and any additional environmental benefits prior to adopting rainwater harvesting across other buildings.
- **#10. Groundwater licensing, extraction, and use** [Option 4F]
  Investigate the feasibility of groundwater to supplement the resort's water supply (including aquifer quality and capacity) and potential environmental and ecological risks (including potential impacts on alpine wetlands and threatened species) in a changing climate. [This option is not supported by some stakeholders]
- **#11. Stormwater harvesting** [Option 4G]
  Investigate the feasibility of harvesting stormwater from one or more identified drainage systems to provide an additional water supply for snowmaking and reduce stormwater flows into the alpine environment. Considerations include the quality of filtered stormwater and its suitability for snowmaking, infrastructure requirements and potential ecological impacts and benefits. Identified drainage systems have catchment areas of between 1,000 and 15,000 square metres and include the visitor car park, Hotplate Drive, Lawlers Court, and opposite Zirkys. Recommend this investigation be completed after recommendations #7 to #10 due to the complexity and variability of supply of this resource.
- **#12. Covering of storage ponds** [Option 4I]
  Commence a field trial to monitor evaporation rates in Loch Dam. Evaluate monitoring data to quantify the potential benefit of covering the water storage to reduce evaporation and investigate surface cover options suitable for alpine environments.

Upgrades and extensions of the snowmaking network are ongoing and are therefore not necessary as a specific recommendation.

6.2 Not recommended

Water for mini and/or pumped hydro-electric energy (Options 3A and 3B) will be considered as part of separate asset protection / power investigations and are therefore not recommended in this plan.

Increasing water storage capacity (Option 4A) was shown to have limited impact on the ability to make snow when needed and is therefore not recommended. A new water extraction / diversion from the upper Diamantina River (Option 4B) was not supported by stakeholders and is not recommended. Snowmelt harvesting (Option 4H) is not recommended due to challenges associated with the use of recycled water for snowmaking.

7 Action plan

The delivery of this plan is contingent on available resources and grant funding to support ARV to upgrade the resort and create an integrated water management demonstration site.

The following table lays out the broad set of tasks and staging of projects that is recommended to meet the IWM and ARV objectives of the site.

Table 2. Action plan and staging of projects

Timing	Name / Option	Task(s)	Link to objectives	Theme	Indicative cost	Lead	Water supply (ML / year)
Immediate	Option 1A & 1B - TO	• Continue developing relationships with Traditional Owners and build understanding of cultural values of water at Mt Hotham • Identify longer-term opportunities for knowledge sharing / working together.	Cultural and community values	Good water management	TBC	ARV	NA
Immediate	Option 1D & 1G – leaks and maintenance	• Ongoing maintenance work to ensure integrity of the system, stop leaks, and maintain existing infrastructure.	Water efficiency and sustainable asset management	Good water management	Ongoing opex	ARV, EPA	> 0.5 ML / year
Short term (1 to 3 years)	Option 1D & 1E - metering	• Efficiency and leak detection. Systematically review every single tap, toilet, hose and water outlet to ensure all units are very water efficient (as per WELS rating) and water efficient flow restrictors in place, over a 3-year period.	Water efficiency and sustainable asset management	Good water management	$10,000	ARV	8 ML / year (based on industry average of 10% leaks and efficiency)
Short term (1 to 3 years)	Option 2A – stormwater management	• Identify specific areas where the placement of old logs or coir logs, or other WSUD options and rock protection, would	Environmental management and	Environmental management	$10,000	NE CMA, ARV	NA

Timing	Name / Option	Task(s)	Link to objectives	Theme	Indicative cost	Lead	Water supply (ML / year)
		be useful to retain sediment and leaf litter, and reduce erosion risk, around car park 1 and 2. Locations must be below the edge of the asphalt, to ensure graders are not affected when clearing snow from the car park. • Monitor effectiveness of these stormwater interventions.	sustainable asset management				
Short term (1 to 3 years)	Option 4A: increase storage size (and supply)	• Investigate the concept and business case for increasing the storage capacity of Loch Dam by 5 to 15 ML.	Safe, secure, affordable water supplies	Future water resilience	$50k to 100k for business case and design	ARV, Goulburn-Murray Water	Capacity increase, not supply
Short term (1 to 3 years)	Option 4C: Formalise 3rd diversion and pump (Swindlers)	• Pending consultation and approvals, design an appropriate weir, pump and pipe system to pump from a third weir, near the bottom of the Blue Ribbon run, to support potable and snowmaking supplies.	Safe, secure, affordable water supplies	Future water resilience	$500,000+ (weir, pump and 1160 m pipe)	ARV	25 ML – 75 ML / yr
Short term (1 to 3 years)	Option 4E: Rainwater harvesting	• Investigate the concept and business case for delivery of a few rainwater tank storages near high usage areas for the replacement of potable water for toilet flushing.	Safe, secure, affordable water supplies	Future water resilience	$25,000	ARV	0.1 ML / year
Short term (1 to 3 years)	Option 4F: Groundwater licensing, extraction and use	• Investigate the concept and business case for groundwater bores, after an initial discussion on allocation and licencing	Safe, secure, affordable water supplies	Future water resilience	$50k to 100k for business case and design	ARV, Goulburn-Murray Water	35 ML / year
Medium term (4 to 9 years)	Option 4G: Stormwater harvesting	• Investigate the concept and business case for stormwater harvesting, at two or more locations, to harvest water and reuse for snowmaking. .	Safe, secure, affordable water supplies AND Healthy	Future water resilience	$50k to 100k for business case and design	ARV	10 ML (over winter, or up to 35 ML / year)

Timing	Name / Option	Task(s)	Link to objectives	Theme	Indicative cost	Lead	Water supply (ML / year)
			and valued waterways				
Medium term (4 to 9 years)	Option 4I: Covering of storage ponds	• Conduct a trial to measure the scale of evaporation losses from the surface of the storage ponds. • Investigate the concept and business case for covering the surface of the storage pond to reduce evaporation losses.	Safe, secure, affordable water supplies	Future water resilience	$250,000	ARV	1ML /year
Long term (10+ years)	-	• Revisit the need for increased snowmaking at the resort, especially if there is a need to increase the area that snowmaking covers.	Safe, secure, affordable water supplies	Future water resilience	NA	NA	NA

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Appendix A. Workshop 1 summary report

Appendix B. Workshop 2 summary report

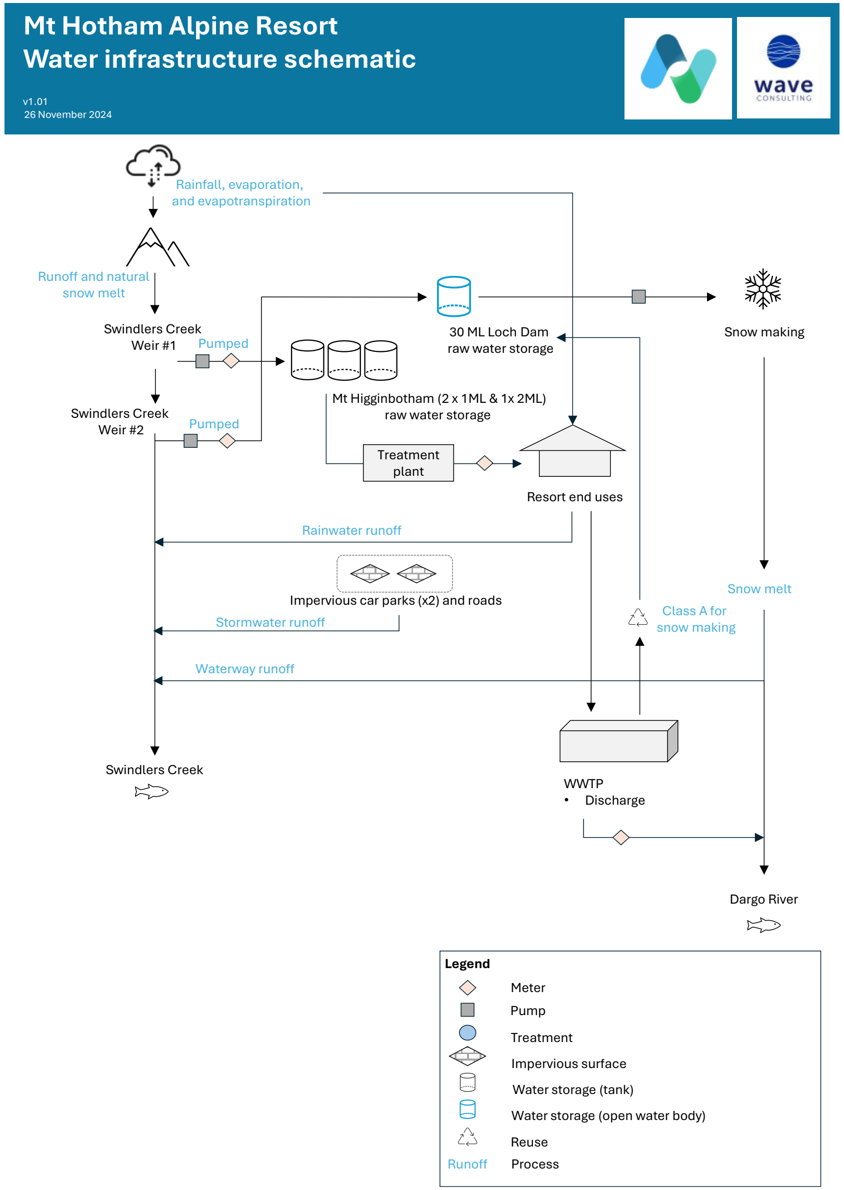
Appendix C. Available data

Data for this project came from a variety of sources. These are listed below, with reference to the time period that the data covers.

Table 3. Data sources and records

Variable	Source	Start	End
Snow (natural)	ARCC_DailySnowDepthRecordsMtHotham_from_1993.csv	1998	2023
Snow (making)	ARCC_DailySnowDepthRecordsMtHotham_from_1993.csv and 'Hotham Snowmaking water usage.xls'	2006	2024
Potable consumption	FLOW SUMMARY 2018-24.xls	2010	2023
Recycled water	FLOW SUMMARY 2018-24.xls	2013	2024
WWTP discharge	FLOW SUMMARY 2018-24.xls	2013	2024
Rainfall	BOM - Mount Hotham station 83085	1940	2024
River levels	VICTORIA @ V. FALLS	1989	2024
Temperature (min and max)	BOM - Mount Hotham station 83085	1997	2024
Temperature (hourly)	BOM - Mount Hotham station 83085	1994	2024
Humidity (hourly)	BOM - Mount Hotham station 83085	1994	2024
Wet bulb (hourly)	NA		
Wind (hourly)	BOM - Mount Hotham station 83085	1994	2024
Visitor days - winter	ARCC_Annual_Winter_VisitorDays_Historical_Records_from_1985.csv	1985	2024
Visitor days - summer	ARCC-Summer-18.19-vis-nos-and-vehicle-countB.csv	2007	2024
Assets - tanks etc	ARV geospatial data	-	-
Assets - stormwater	ARV geospatial data	-	-
Assets - impervious	ARV geospatial data	-	-

Appendix D. Water schematic



Appendix E. Traditional owner's summary

Appendix F. Stormwater modelling

Modelled was undertaken to assess the capacity of the stormwater network at Mt Hotham, and the potential erosion risk. A complete summary of this work is in a related report “Review of Stormwater Infrastructure at Alpine Resorts” (Wave Consulting Australia, 2025). Some of the main results from this report are shown below, but it should be noted that the input data on the stormwater networks was incomplete, and some assumptions were made regarding the location of pits and pipes.

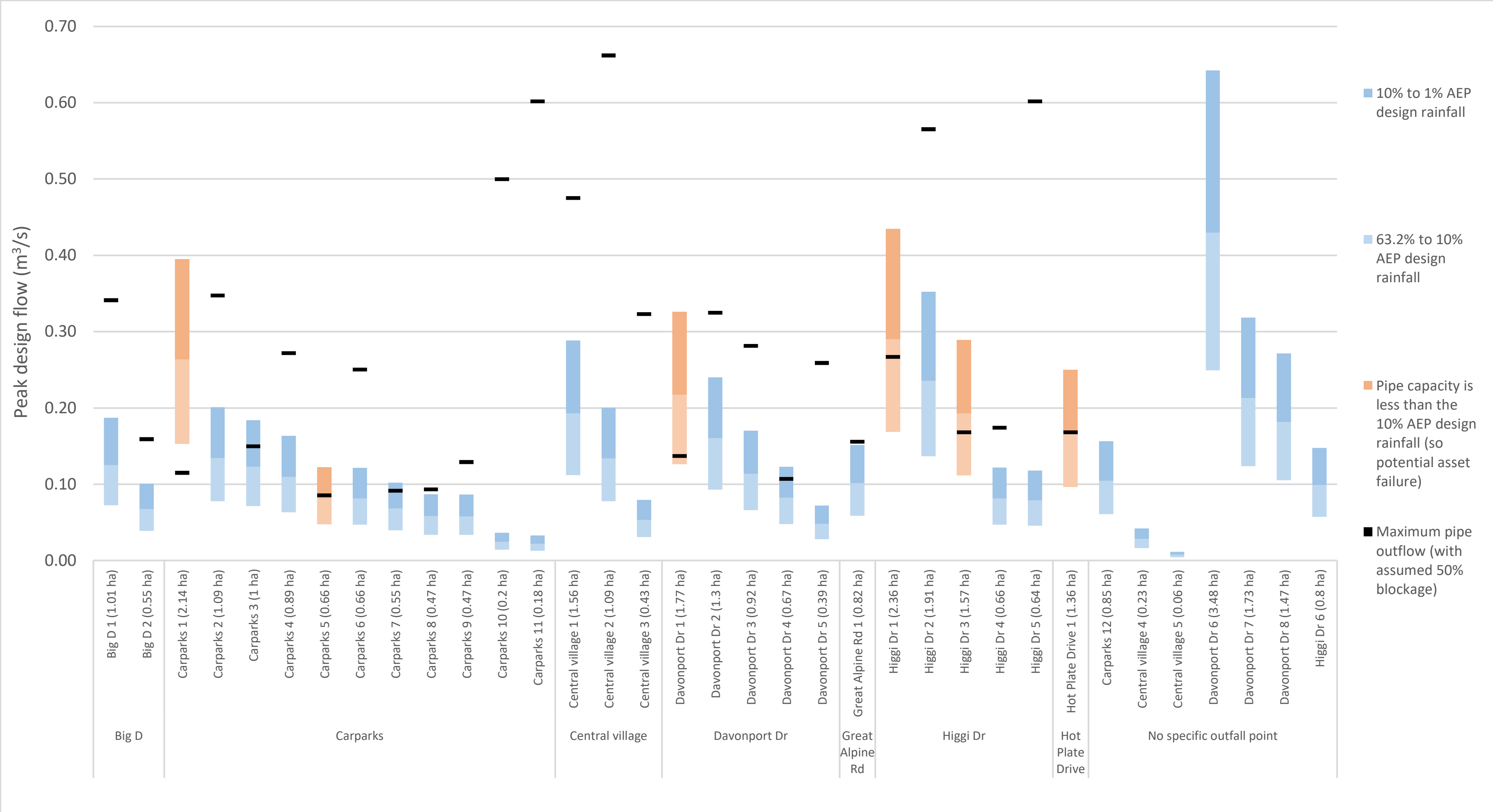


Figure 23. Stormwater capacity issues highlighted across Mt Hotham resort.

Figure 23 is the summary of modelling of the capacity of the stormwater network across all catchments. The orange colours are the ones of interest as they indicate that these pipes are not able to cope with the 10% AEP storm and should be investigated for potential infrastructure upgrades.

8.1.1 Review of stormwater capacity and pipe network with climate change

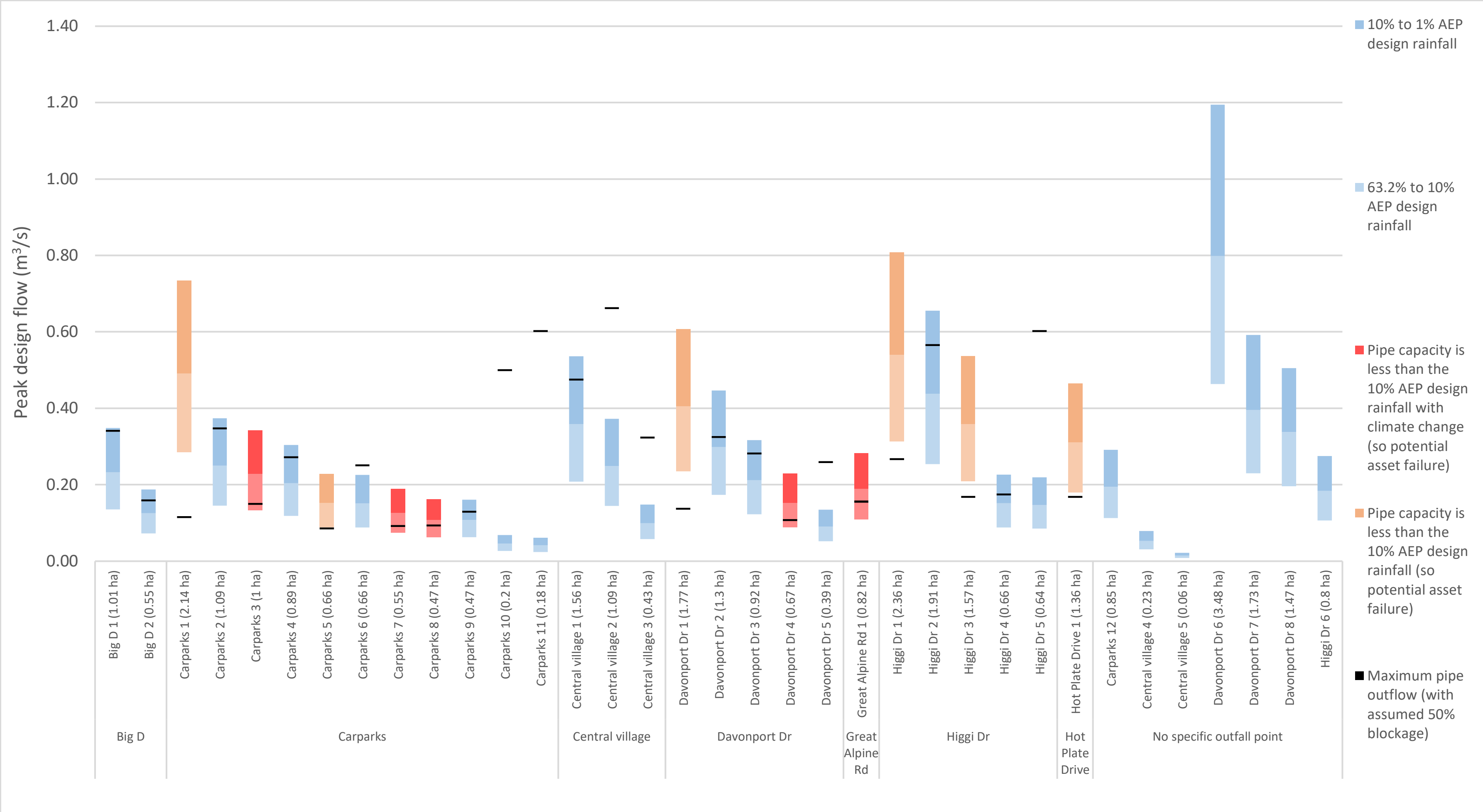


Figure 24. Stormwater capacity issues highlighted across Mt Hotham resort with projected effect of climate change on rainfall.

When climate change is considered and the potential to have more intense storms (but less rainfall overall), we find that there are five more catchments and outlet pipes that may not cope with a 10% AEP storm, and should also be considered for upgrades, noting that these forecasts relate to 2100 climate change forecasts.

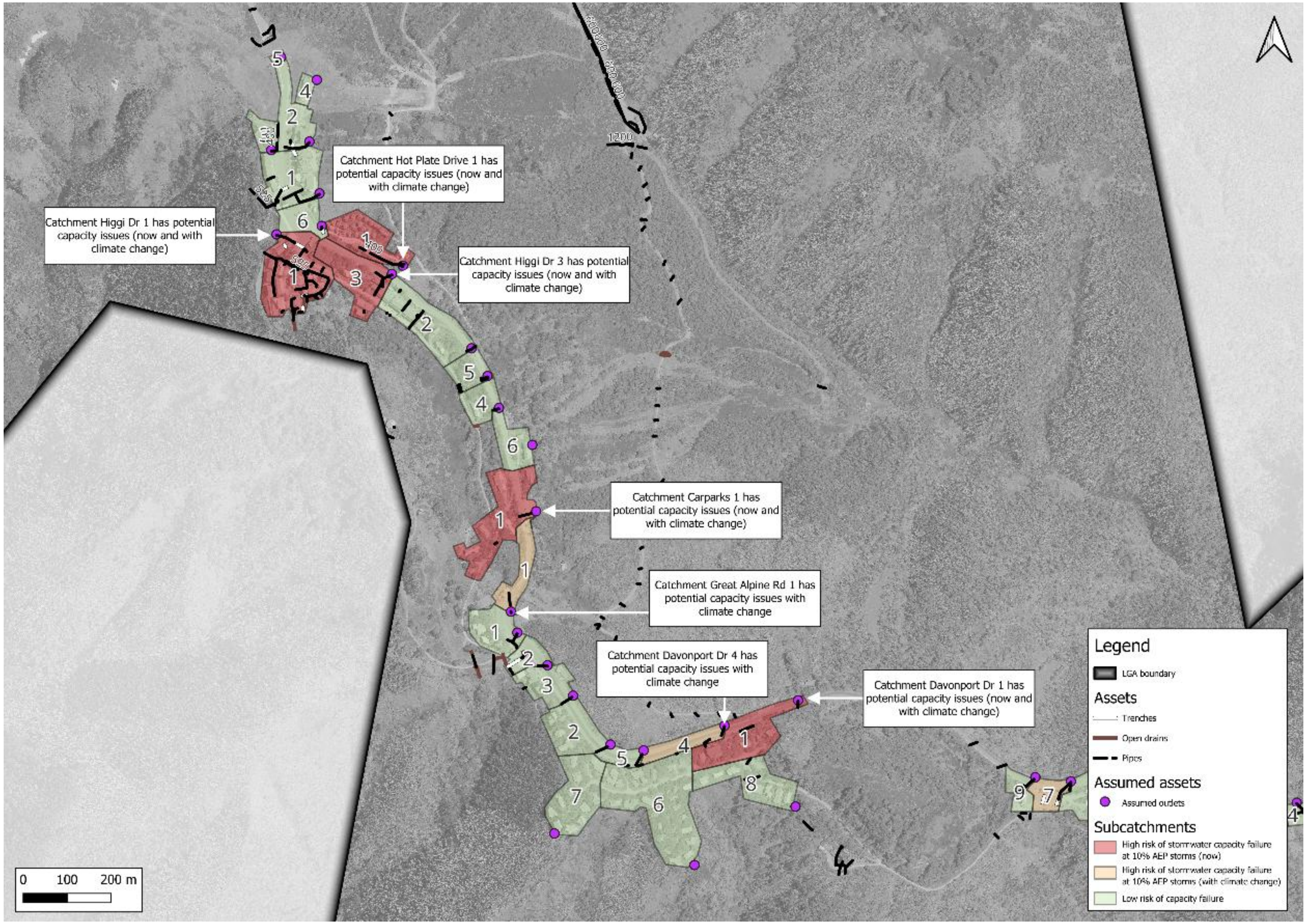


Figure 25. Locations of stormwater network that are undersized based modelling at Mt Hotham Alpine Resort (north).

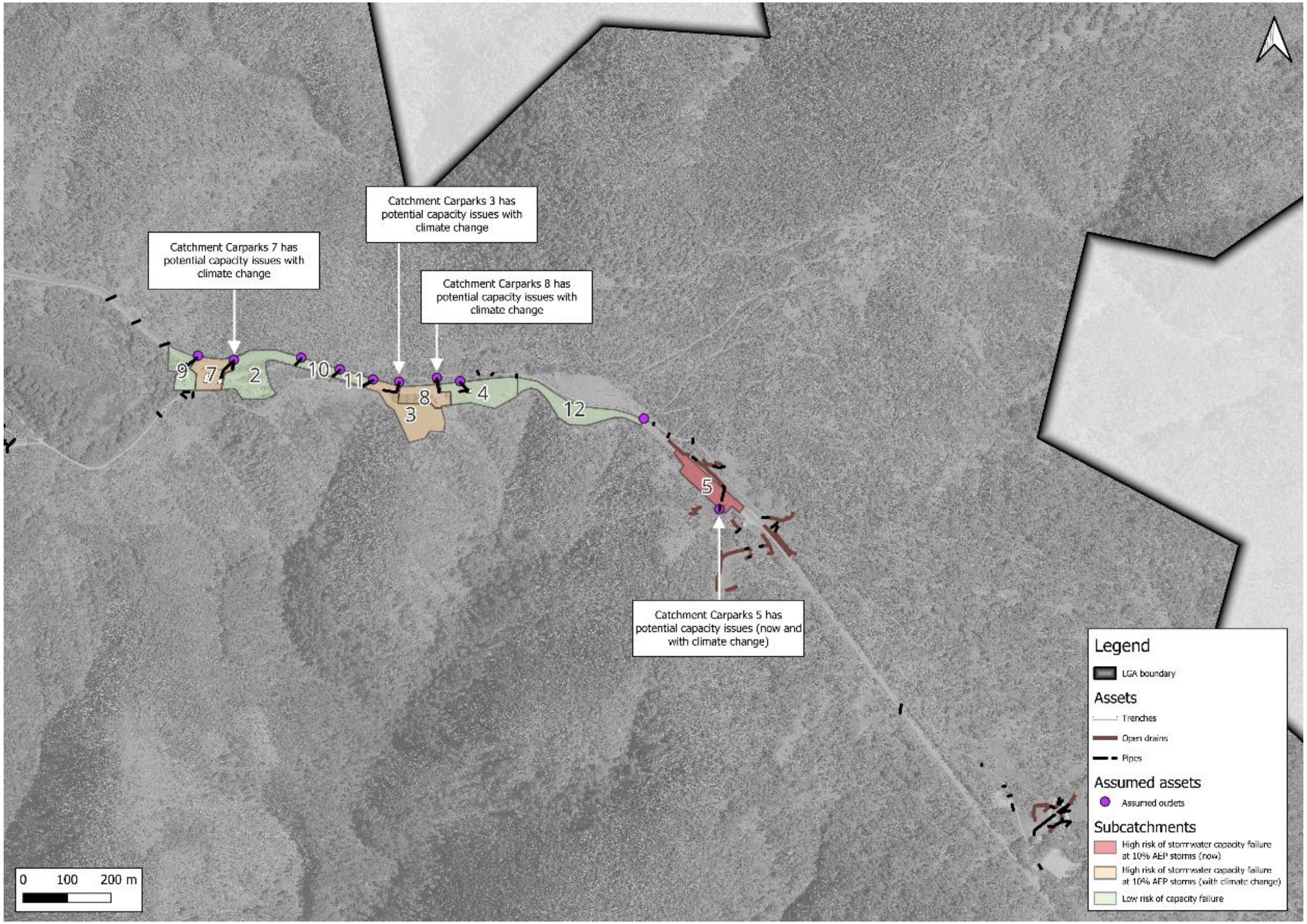


Figure 26. Locations of stormwater network that are undersized based modelling at Mt Hotham Alpine Resort (south).

8.1.2 Identifying erosion risks at outlets

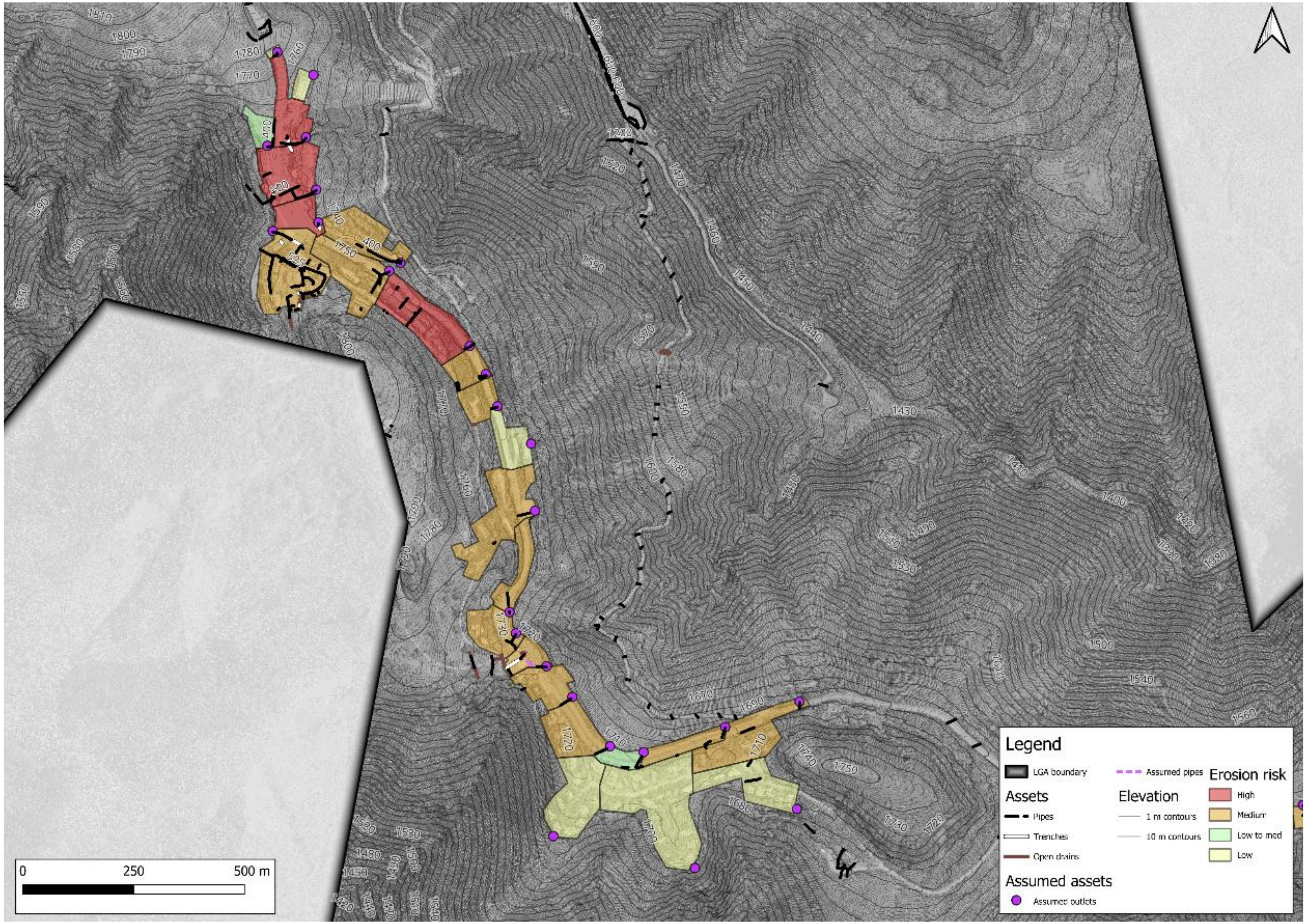


Figure 27. Erosion risk across all catchments in Hotham Alpine Resort (north).

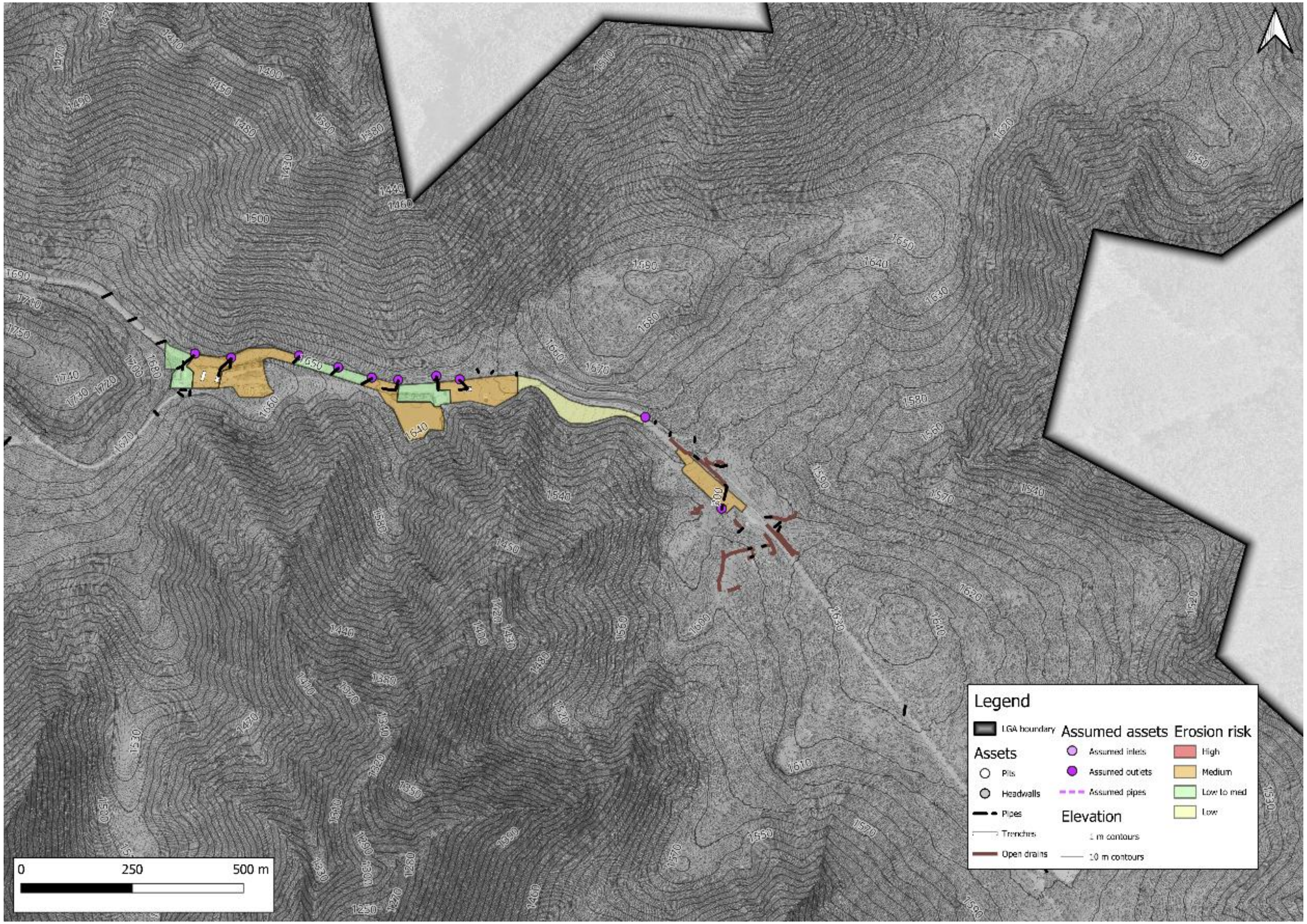


Figure 28. Erosion risk across all catchments in Hotham Alpine Resort (south).

Figure 27 and Figure 28 show that due to the nature of the size of catchments, and slope, there are only a few areas that have a high risk of erosion where the stormwater enters the downstream alpine environment, mostly in the northern area near the admin building. Based on the semi-quantitative analysis in Figure 28, it may be worth considering a more detailed assessment of the local environment and risk of erosion, and how to mitigate this risk (thinking of actions within the catchment and at the outlet).