

**BEFORE THE FRESHWATER HARING PANEL CONVENED BY THE CHIEF
FRESHWATER COMMISSIONER**

IN THE MATTER of the Proposed Otago Regional Policy
Statement

AND

IN THE MATTER of the Re-notified Freshwater Planning
Instrument

STATEMENT OF EVIDENCE OF DR DAVID TALBOT JORDAN FOR

- 1. STRATH CLYDE WATER LIMITED, MCARTHUR RIDGE INVESTMENT GROUP LIMITED AND MOUNT DUNSTAN ESTATES LIMITED.**
- 2. MCARTHUR RIDGE VINEYARD LIMITED.**

Dated 28 June 2023

Instructing Solicitor:
Norman Elder
AWS Legal
PO Box 1207
Invercargill
Telephone: (03) 211 1370
Email: norman.elder@awslegal.co.nz

Counsel Instructed:
Kelvin Reid
Canterbury Chambers
PO Box 9344
Christchurch 8149
Telephone: 021 997 343
Email: kgr@kelvinreid.co.nz

- 1 My name is Dr David Talbot Jordan.
- 2 I hold a Doctorate (PhD) in Viticulture from Oregon State University, USA and a first class honours degree in Horticultural Science from Lincoln University, New Zealand.
- 3 I have been involved with the grape and wine industry since 1983. My original expertise was as a Viticultural Scientist. I was the leader of the National Viticulture research programme for Ministry of Agriculture and Horticultural Research Institute from 1989-1994. In 1994, I established Vine to Wine and have gained significant commercial experience in the grape and wine industry since that time.
- 4 I have amassed extensive experience of the commercial production of grapes in vineyards and wine businesses with clients throughout New Zealand and Australia, including Central Otago. Since 1994 I have consulted to a range of Central Otago vineyard and winery clients and maintain an active current client base in the region. This client work included the original property evaluation and planning of the vineyard that has now become McArthur Ridge, McArthur Road, Alexandra.
- 5 I have held many industry chair and committee positions over the years. I was instrumental in the development of the Sustainable Viticulture Production Scheme as a founding member of the working party in 1994, and am a past chairman and long serving committee member of the NZ Society for Viticulture and Oenology. I was the Programme Leader of the Lighter Wines PGP Programme (2014 to 2022). This was the largest New Zealand Winegrowers-initiated research programme, which provides knowledge and technology for the production of lower alcohol and lower calorie wines.
- 6 I have performed economic reviews of the NZ Wine Industry that have been used to describe the economic benefits of the wine industry on a regional and national level.
- 7 My knowledge of vineyard performance and experience with the commercial aspects of grape growing in Central Otago are particularly relevant to the development of guiding principles and considerations for

establishing relevant Policy Statements that reflect the requirements and prudent management of supplementary irrigation for vineyards.

- 8 In preparing this statement of evidence I have considered the following documents:
- (a) Proposed Otago Regional Policy Statement June 2021.
 - (b) Written Submission on Proposed Otago Regional Policy Statement 2021 by McArthur Ridge Vineyard Limited, Strath Clyde Water Limited, McArthur Ridge Investment Group Limited, and Mount Dunstan Estates Limited. 29 November 2022.
- 9 I have been asked to prepare this evidence on behalf of Strath Clyde Water Ltd (**SCWL**), McArthur Ridge Investment Group Limited, Mount Dunstan Estates Limited and McArthur Ridge Vineyard Limited. The McArthur Ridge vineyard development encompasses the McArthur Ridge Vineyard and Mount Dunstan Estates Vineyard. The two vineyards are operated independently other than water which is supplied by SCWL who owns and operates the water infrastructure.
- 10 As a technical expert, I presented evidence (4 February 2021) and attended the associated Environment Court Hearing (ENV-2020-CHC-127) of the Water Permits Plan Change – Plan Change 7, being part of a proposal of national significance directed by the Minister for the Environment to be referred to the Environment Court under section 142(2)(b) of the RMA.

Code of Conduct for Expert Witnesses

- 11 I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2014. I have complied with the Code of Conduct when preparing my written evidence and will do so when I give oral evidence. Other than when I state I am relying on the advice of another person, this evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Scope of Evidence

- 12 This evidence addresses:
- (a) Background to the NZ Wine Industry

- (b) Background to the wine industry in Central Otago
 - (i) Basic commercial and economic benefits of vineyards in Central Otago:
 - (A) Regional contribution of cash expenses and revenue earned
 - (B) Labour inputs
 - (ii) Ecological credentials of vineyards and the consideration impacting on sustaining the soil and freshwater environment.
- (c) Commercial grape growing and the role of supplementary irrigation
 - (i) Why reliable water of adequate volume and quality is critical for commercial vineyards.
 - (A) Productivity
 - (B) Grape and wine quality
 - (ii) Typical irrigation volumes
 - (A) Compared to other primary industries
 - (iii) How water is used and applied
- (d) Water for frost mitigation in commercial vineyards
- (e) Critical policy considerations as they pertain to the provision of water for vineyards.

Summary of Key Points

- 13 A reliable supply of water in sufficient volumes and quality is critical for the sustained commercial performance of premium vineyards in Central Otago.
- 14 McArthur Ridge Vineyard is a good example of a modern vineyard that has invested in optimising the water use for its operations.
- 15 In contrast to pasture-based primary industries where the produce is directly linked to the animals that graze on the pasture, the commercial produce from vineyards is a crop (grapes) and the volume and quality of this product is directly linked to the water available to the vine during the growing season.
 - (a) Unlike pastoral production, a crop “failure” cannot be mitigated if there is insufficient water or reliability for irrigation and/or frost fighting is compromised. In pastoral systems, supplementary feed in the form of baleage or hay or grain or grazing out of the district (destock) can maintain animal health and production. These options do not exist for vines and vineyards.
- 16 Vineyard irrigation is very efficient:
 - (a) Applied by precise flow dripline along the vine row, the water is targeted to the soil immediately around the cropping plant (vine) that:
 - (i) Minimises evaporation and run-off losses.
 - (ii) Irrigates only a portion of the occupied land.
 - (b) Optimises the amount of water applied to balance vine growth and cropping with both over and under irrigating having significant commercial implications that create a moderating factor to the amount of water applied.
 - (c) Compared to other primary industries, daily peak water use by vineyards is about 25% of that of pasture and about 40% of other perennial horticultural crops (e.g., cherries).
- 17 Vineyards and how they are managed have high ecological credentials that result in minimal impact on the environment and freshwater assets.

- (a) The NZ Wine Industry has a well-developed environment sustainability programme (NZ Sustainable Winegrowing) that was established in 1994.
 - (b) Detailed field and ground water research has shown minimal or no impact on groundwater quality from vineyard activities and have the lowest diffuse discharge profile of any other intensive land use activity.
- 18 During the process of establishing policies for the allocation of water for irrigation to land-based industries the following should be considered for vineyard entities:
- (a) Vineyards have distinctly different irrigation requirements to pasture-based irrigators.
 - (b) Irrigation water is critical to support the productive performance and wine quality.
 - (i) Irrigation is required every season.
 - (ii) The most important and dependent time for water in vineyards is during the unseasonal dry periods (droughts) that occur infrequently but need to be factored into the allocation of water for vineyards.
 - (iii) Without sufficient irrigation vines will experience reduced yields and inferior wine quality. The viability of a vineyard will quickly be jeopardised.
 - (c) Another distinction is the use of water for frost mitigation. If vineyards have chosen to use water for frost mitigation, then water needs to be available for this purpose. Without this water reliable frost mitigation is not available and the vineyard performance will suffer and potentially jeopardise the viability of the vineyard business.
 - (d) Crop loss because of frost damage or severe drought could result in a degree or total financial failure for the vineyards. Either in the short or long-term, these financial failures will have many direct impacts on the regional and national economies through the lack of expenditure

within the region and revenue generated coming into the region and at a national level as export earnings.

- (i) Another direct impact is the loss of employment with vineyard failure. Vineyards employ in the order of 1 FTE per 3.3 to 4.8 ha of vineyard.
- (ii) Vineyards that are constrained financially also have indirect impact on the regional businesses that service the vineyard and wine industry like:
 - (A) Irrigation and machinery maintenance providers
 - (B) Fertiliser and fungicide suppliers.

NZ Wine Industry

- 19 The NZ Wine Industry is the 6th largest export earner for New Zealand and generated \$2.41 Billion of export receipts for the 12 month period up to April 2023 (reference: NZ Winegrowers, April 2023 Export Statistics Report).
- 20 Over 700 wineries make-up the NZ Wine Industry and are located throughout the country with a focus on the areas with drier climates and free draining soils.
- 21 As at January 2023 there was a total of almost 41,860 hectares of vineyard throughout New Zealand, with Marlborough the largest region having almost 29,654 ha or 71% of the area of national vineyard (NZ Winegrowers Vineyard Register January 2023).
- 22 The success of the NZ Wine Industry is based on producing wines that are highly appealing to wine consumers throughout the world by offering well-made and reliable wines that are flavour rich and refreshing. Marlborough Sauvignon blanc has become the world benchmark for wine made from this variety. On the back of the success of this wine style has been the development of other wines with increasing volumes being exported like Pinot gris, Rosé, Chardonnay and Pinot noir.

Central Otago Wine Industry

- 23 Central Otago Wine Industry has a multi-decade history and an international reputation of producing world class Pinot noir, Pinot gris, Riesling and Sparkling wines.
- (a) It is a valuable part of the economic landscape in the region through its direct contributions.
 - (b) Also, it has many indirect contributions by creating destinations for domestic and international tourists. Tourism NZ studies have shown that 1 in every 4 tourist visitor includes a visit to a winery or cellar door when on holiday in a wine producing region. Central Otago Wine Industry has a well-developed cellar door and winery destination network.
- 24 In 2023 there are about 2,054 ha of vineyard in the Central Otago region (NZ Winegrowers Vineyard Register, January 2023). These plantings stretch from near Lake Hayes, to Wanaka and Tarras and through to around Alexandra.
- (a) The highest concentration of the plantings is around Cromwell including Bannockburn, Lowburn and Bendigo, and in the Alexandra basin.
- 25 The region is considered arid and the rainfall at many of the vineyards during the growing season is at least half that experienced in Marlborough.
- 26 To establish a commercial vineyard with vine and row spacing, trellis, irrigation and frost protection typical of many Central Otago vineyards, including vine tending over three years to get the vines to their first commercial crop (60% of full production), costs an average of \$95,500 per ha.
- (a) These costs have not included any consideration for water storage (dam) structures if they are required or any specific site preparation.

- (b) This sum assumes that the vineyard does not own any vineyard equipment or directly hire any staff. All machinery and labour requirements, plus management, is projected to be provided under contract from a local vineyard management company.

- 27 A new vineyard development, with no issues during establishment, will achieve the potential for full development by the end of the fifth growing season.

- 28 Compared to many other primary industries in the region the production of commercial wine grapes is intensive. Annual operating expenses are in the order of \$20,000 to \$25,000 per ha. Of these about 60 to 70% are labour costs.
 - (a) Using an average wage of \$57,200 per year there is about 1 FTE per 3.3 to 4.8 ha of vineyard.
 - (i) So, the vineyard industry in Central Otago utilises about 620 FTE directly in the vineyard. This is a mix of seasonal and permanent staff.
 - (ii) This figure does not account for labour employed in the industries that support the vineyards in the wider community. Examples of these industries are:
 - (A) Tractor repairs and servicing
 - (B) Irrigation maintenance providers
 - (C) Fertiliser and fungicide suppliers.

- 29 Vineyard revenue as a grape growing entity is derived from two variables:
 - (a) Yield of grapes.
 - (b) Dollars per unit of weight of grapes (typically \$ per tonne).

- 30 Commercial vineyards in Central Otago experience yield variation that reflects seasonal weather and the impact of frost damage (as frost mitigation is rarely 100% effective).

- 31 A good example of this variation is the yield difference between the 2017 (cool) and 2018 (hot) seasons. Many vineyards in the region experienced Pinot noir yields in 2017 in the order of 70% of the 2018 yield.
- 32 The low yields in 2017 were region-wide and the average yield was 4.2 t per ha based on New Zealand Winegrowers published yields and the Vineyard Register to determine the total area of producing vineyard.
- 33 Typical yields for Central Otago are in the order of 5 to 5.5 t per ha (once the vineyard is mature – from the fifth and subsequent growing seasons under most establishment regimes). Most winemakers buying grapes at average market prices would demand that the crops not exceed this figure so providing a cap to the yield performance.
- 34 Grape prices are negotiated between the purchasing winery and the vineyard. The average price for the major grapes varieties in Central Otago for the 2021 harvest were (NZ Winegrowers Vintage 2022 Average Grape Prices \$/Tonne Report, 01 February 2023):
- (a) Pinot noir: \$4,122 per tonne.
 - (b) Pinot gris: \$2,732 per tonne.
- 35 Many of the vineyards in Central Otago are owned or directly linked to a winery and the financial contribution is linked to the production and sale of a high value product in the form of bottled wine. These vineyards then have a higher contribution to the regional economy. The costs and contributions are variable across the winery entities but an approximation of the revenue would be in the order of equivalent of \$10,000 to \$18,000 per tonne based on \$12 and \$20 per bottle wholesale prices respectively. To be clear, this is not profit but equivalent to the typical wholesale value of Central Otago Pinot noir wine.

Sustainable Winegrowing New Zealand

- 36 Sustainability is a crucial component of the New Zealand grape and wine industry.
- 37 The Sustainable Winegrowing New Zealand scheme has been in operation for over 25 years and was established by the New Zealand grape and wine industry to provide guidelines and standards for best practice across the different aspects of the entire wine production chain. It is recognised internationally as a global leader.
- (a) Participation is very high with in the order of 96% of the national vineyard area and over 90% of the wine produced in a certified facility.
 - (b) Membership is voluntary.
 - (c) Members must submit comprehensive information via a questionnaire about their management of the vineyard and the production of the wine and how this compares to the guidelines of best practice with the goal of protecting the environment and the people in that environment.
 - (d) The responses from the members are externally audited.
 - (e) In 1994 I created the founding approach and standards, plus facilitated the evaluation of the Programme and its early adoption.
- 38 Water management is a critical aspect of sustainability. The New Zealand Wine industry has a stated goal to “Be a world leader in efficient water use and the protection of water quality”.
- 39 Every year the Sustainable Winegrowing New Zealand produces a National Water Use Report from the latest annual information submitted by the members.
- (a) This provides a snapshot of the vineyard and winery water use nationally and at a regional level.
 - (b) These summaries enable scrutiny of the water use and trends over time. With this information it is possible to develop guidelines to enable the New Zealand wine industry to achieve its stated goal of being a leader in efficient water use.
- 40 In the most recent sustainability report (New Zealand Winegrowers Sustainability Report 2022) the vineyards reported:

- (a) 97% optimise their water use.
- (b) 92% of the vineyards have practices or initiatives to conserve water.
- (c) 89% have leak detection and repair programmes.

Role of Supplementary Irrigation for Commercial Vineyards

- 41 The annual rain fall in Central Otago is insufficient to support the seasonal and long-term productivity of vines in a commercial vineyard. A reliable supply every year of suitable water for supplementary irrigation is critical to achieve sustainable productivity of vineyards in Central Otago.
- (a) Without irrigation the vines would not have a commercial harvest and the vines would become un-productive under most seasonal rainfall patterns in Central Otago.
 - (b) Short durations, particularly at critical times of peak water use, of no water can cause devastating commercial losses. Reliable water supply throughout the season is very important for vineyards.
 - (c) In the other dimension, excessive available water if the vines are over irrigated results in vines that become vegetative (vigorous growth in leaves and shoots) and have diminished productivity.
- 42 Additionally, supplementary irrigation is critical for the quality of the grapes and the resultant wine. Grape and wine quality is directly linked to the vine water status.
- (a) Water stressed vines typically produce wines of inferior quality. Severely stressed vines will defoliate (partially and, in severe stressed situation, completely defoliated) and defoliated vines lose the ability to ripen grapes with the potential to have complete crop failure.
 - (b) Over watered vines also have inferior quality grapes and typically have a higher risk of disease for both the vine and the grapes.
- 43 The balance of maintaining moderate vine growth of not too strong and not too stressed under the direct influence of the amount and timing of the

application of irrigation water effectively results in conservative irrigation management in vineyards.

- 44 Vineyard irrigation water is applied via a targeted and refined system under automated control of in-line emitters or drippers in or on lateral tubing along the vine rows. The application of water via this infrastructure results in a wetted strip along the vine rows. It is not a broadcast form of water application.
- (a) Typical vine rows are 2.2 to 2.5 m apart and the wetted strip from the drippers is typically about 300 mm wide, so the wetted surface is in the order of 12 to 13% of the total land area (1300 m² of the 10,000 m² in a hectare).
 - (b) This form of targeted application reduces the losses of water via evaporation or run-off.
 - (c) Inherent in these irrigation systems are very high-water distribution and emission uniformities.
- 45 Supplementary irrigation in vineyards matches the seasonal and daily water demands of the vines.
- (a) Irrigation demands are low in the beginning and ends of the growing season (1 October through to late April).
 - (b) The peak water demand typically aligns towards the end of summer and when the conditions are hottest and driest.
 - (i) Also, at this time the leaf canopies of the vines are complete resulting in the maximum evaporative surface for water loss.
 - (ii) Plus the building load of the grape crop as the berries enlarge stimulates high water use by the vines at a similar time.
 - (c) Irrigation is managed to balance available soil water and the vine's requirement for water. For example, if there has been rain the volume of water applied by irrigation is reduced.
 - (i) Soil moisture levels are monitored closely in vineyards with a range of approaches including manual soil investigation

through to specific technology (at McArthur Ridge Aquaflex and neutron probes are used) at that provides real-time soil moisture levels.

- (ii) An index of vine water status can be monitored too. This involves visual assessments and technology that directly measures the vine water status.
- (iii) The combination of soil moisture and vine water status is used to guide the amount of irrigation water that is applied in vineyards.

- 46 Often soil moisture deficits are large in vineyards and the target soil moisture content approaches wilting point in the vine root zone. Irrigation is applied to maintain this target soil moisture content above the wilting point ensuring that the vines are not water stressed and vegetative growth is optimised. As a result of the large soil moisture deficits, drainage from the root zone is unlikely, if at all.
- 47 Reviewing soil moisture records at McArthur Ridge for the growing seasons 2019-2020 and 2020-2021 revealed the parsimonious and strategic use of irrigation, large soil moisture deficits and the absence of drainage from the root zone.
- (a) In 2019-202 there was 340 mm of rainfall and 135 mm of irrigation, all of which was retained in the root zone with no sign of increase in soil moisture in the deep layers (down to 1.2 m).
 - (b) In 2020-2021 there was 322 mm of rainfall and 220 mm of irrigation. Again, all the rainfall and irrigation was retained in the rootzone.
 - (c) In comparison, pastoral and arable irrigation with relatively shallow rooted plants (compared to grapevines) does not typically utilise large rainfall events and with much higher irrigation water applications would experience significant drainage from the soil profile.
- 48 No two irrigation seasons are the same and the total water use for irrigation will vary based on prevailing weather conditions and size of the crop (yield).
- 49 The combination of detailed management and targeted application of irrigation in vineyards results in total volume of irrigation water used considerably lower than that used by other primary industries.

- (a) Approximate volumes of peak daily (l per ha per day) water use for irrigation for broad comparisons are:
 - (i) 25,000 (l per ha per day) for vineyards
 - (ii) 60,000 (l per ha per day) for cherries
 - (iii) 100,000 (l per ha per day) for pasture
- (b) For a typical dry growing season, the total volume of water used by a vineyard for irrigation is about half that of an irrigated pasture in Otago:
 - (i) 3,000 (m³ per ha per season) for vineyards
 - (ii) 6,300 (m³ per ha per season) for pasture. (Claire L. Flemmer & Rory C. Flemmer 2007. Water use by New Zealand dairy farms, 1997–2000, New Zealand Journal of Agricultural Research, 50:4, 479-489)

Water for Frost Mitigation in Commercial Vineyards

- 50 Grapevines are susceptible to frost damage at any stage during the growing season. Typically the spring is when damage to the vine tissue is most likely from frost events as this is when the weather is cooler and frosts are more frequent. At this stage the buds and young shoots of the vines need to be protected from frost. Then again later in the season once the weather cools in the autumn the leaves (and under severe conditions the grapes) need to be protected to retain leaf function and facilitate ripening and flavour development.
- 51 Almost all the vineyards in Central Otago use some form of frost mitigation. The typical approaches are:
- (a) *Helicopters*: using warm air of natural inversion layers to warm the vineyard.
 - (b) *Frost fans*: similar to helicopters but using permanent fixtures in the vineyard to move the warm air around the vineyard.
 - (c) *Overhead sprinklers*: uses the application of water to keep the vine tissue warm through the thermodynamics and energy (heat) release

associated with water transforming from a liquid phase to a solid (frozen) phase.

- (d) There are some minor approaches of using supplementary heat but these are not used on a large scale.
- (e) Of these options the application of water is the most reliable and has the potential to protect the vines from cold temperatures much lower than can be protected with air movement (fans or helicopters). It is the only frost mitigation option for vineyards where inversion layers are not reliable like those in the Alexandra Basin.
 - (i) The application rate and coverage are critical for water to provide effective frost protection. Typical application rates are in the order of 4 to 5.5 mm per hour.
 - (ii) Water for frost protection must be applied throughout the period when the temperature would be below freezing and, depending on conditions, turned on at a temperature higher than freezing and then stopped once the air temperature is above freezing and melts the ice that has formed.
 - (iii) I note that other territorial authorities have considered water for frost fighting as a separate allocation of water e.g., Marlborough District Council and Hawkes Bay Regional Council.

Environmental Credentials of Vineyards

- 52 Vineyards and how they are managed have high environmental credentials that result in minimal impact on the environment and freshwater assets.
- (a) The NZ Wine Industry has a well-developed environment sustainability programme (NZ Sustainable Winegrowing) that was established in 1994. This has been outlined earlier in my evidence.
 - (b) Detailed field and ground water research has shown minimal or no impact on groundwater quality from vineyard activities.

- (i) Three years of monitoring soil water use in vineyards by Brent Clothier and colleagues at Plant and Food Research (Clothier et al (2020). Vineyard Ecosystems; The Gold Site: Soil and Water services and Pehnology. Presentation to Vineyard Ecosystems Advisory Group August 2020) showed that because of the way water is managed in vineyards they return more than 100 mm of water to the aquifer than is extracted for irrigation.
- 53 Compared to pasture-based primary industries, vineyards have considerably lower regimes of fertiliser inputs and often applied via the irrigation system (fertigation) that has high uniformity and efficiency and targeted to the root zone.
- (a) As an example, over the last five years, McArthur Ridge has applied on average 13.7 kg of nitrogen per ha. Compare this to the national average for dairy farms of 110 kg (or 8 times that of McArthur Ridge) of nitrogen per ha (Monaghan et al., 2007. Nutrient management in New Zealand pastures – recent developments and future issues. New Zealand Journal of Agricultural Research, 50:2, 181-201) or 234 kg (or 17 times that of McArthur Ridge) of nitrogen per ha in Canterbury dairy farms in the 2018/2019 season (Serra and Pinxterhuis, 2020, Farming under a N Fertiliser Cap: Learnings from the Hinds and Selwyn Partner Farms and Science Evidence. DairyNZ Technical Series, pp 13).
 - (b) There are also low inputs of the other major nutrients at McArthur Ridge Vineyard with the average for phosphorus over the last 5 years of 3.9 kg per ha (less than 10% of a typical fertiliser regime for dairy farms as noted in the Monaghan et al., 2007 reference above) and potassium of 11.2 kg per ha (5 to 25% of the annual fertiliser input in dairy farms, Anon 2012, Potassium Fertiliser (7-14), DairyNZ Farmfact).
- 54 Nutrient leaching has been studied in vineyards by Brent Clothier and colleagues and showed very low levels of nitrogen and phosphorus leaching, better than the very low end of the spectrum for intensive horticulture and below the low end of extensive agriculture (Clothier and Green (2017). The leaching and runoff from vineyards. In: Science and

Policy: nutrient management challenges for the next generation. Eds Currie and Hedley, Occasional Report No.30. Fertiliser and Lime Research Centre, Massey University, Palmerston North).

- (a) With low levels of drainage from the root zone of vines and vineyards there is low risk of nutrient leaching beyond the root zone.
 - (b) The conclusion of the research by Clothier and colleagues is that vineyards have very strong environmental credentials because of the very low levels of nitrate leaching, parsimonious use of water for irrigation and the net positive recharge of ground water.
- 55 Nutrient losses in a pasture grazing situation is dramatically different to vineyards because of the role of the animal system digesting the pasture and excreting the nutrient back to the farm surface in a form that can be moved out of the farm and into the waterways off farm.
- 56 Within vineyard management systems, and McArthur Ridge is a good example, there are many aspects that contribute to maintaining or enhancing the soil attributes:
- (a) Low fertiliser inputs as described earlier.
 - (b) Infrequent cultivation with the maintenance of a permanent covercrop between the vine rows.
 - (c) Enhanced soil organic levels because of the contribution of the annual prunings and breakdown of the vine roots, plus the carbon additions created by the practice of applying compost along the vine rows or throughout the vineyard.
 - (i) Since 2009, the soil organic matter levels at McArthur Ridge have increased by about 15% from 4% to 4.8%.
 - (d) Return of any nutrient absorbed by the vines is in slow release format (in contrast to animal-based systems) dependent on the slow decomposition of the tissue that falls on the land.
- 57 Soil erosion in vineyards is prevented by maintaining a permanent cover-crop between the rows.

McArthur Ridge Vineyard Development

- 58 The McArthur Ridge vineyard development is a well-established premium Pinot noir producer with a focus on efficiently producing quality grapes at commercial yields for the production of premium Pinot noir wines. Much of the production is utilised for wines that are sold in export markets.
- (a) 183 ha of vines are planted, 174 ha are in production and there is a further 54 ha (total of about 237) that has been prepared with irrigation infrastructure in place.
 - (b) The vineyard plantings are concentrated on the tops and sunny faces of the rolling ridges throughout the property.
- 59 At 183 ha, McArthur Ridge vineyard development is about 8.9% of the total vineyard area in Central Otago and about 11.2% of the area of Pinot noir in the region (NZ Winegrowers Vineyard Register, January 2023).
- 60 The plantings produce considerably higher yields than the regional average and for many vineyards in Central Otago. The average yield over the last 10 years was 7.37 t per ha and the yield in 2023 was 8.30 t per ha.
- 61 The McArthur Ridge vineyards produce on average approximately 1,282 (174 ha x 7.37 t per ha) tonnes of Pinot noir grapes per year. NZ Winegrowers publishes annual records of the Pinot noir harvest in New Zealand. Based on the published numbers, the McArthur Ridge vineyards account for approximately 13 to 20% (with 16% the average over the last 9 years) of the Pinot noir crop produced in Central Otago, and 3 to 6% (average of 4% over the last 9 years) of New Zealand's total Pinot noir crop (NZ Winegrowers Vintage Reports, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021 and 2022).
- 62 The economic contribution of the 183 ha McArthur Ridge vineyard development to the Central Otago Region can be summarised, based on information provided to me by McArthur Ridge Vineyard:
- (a) Annual operating (cash) expenses of approximately \$3.39 million (183 ha x \$18,500 per ha – see #25. Note this does not include

business overhead costs and business costs like interest, depreciation, and taxation.

- (b) The vineyard employs 10 to 12 permanent staff and seasonal staff peak at about 25.
- (c) Average revenue from grape sales of approximately \$5.29 million (7.37 t/ha x 174 ha x \$4,122 per tonne) based on the average yield at McArthur Ridge for the last 10 seasons and the average grape price in 2022 for Pinot noir in Central Otago as collated by NZ Winegrowers.
- (d) Wine revenue from the grapes grown at the McArthur Ridge vineyards that are processed in Central Otago \$4.23 million (a third of the total production so 423 t x \$10,000 per tonne).
 - (i) Of the total harvest from McArthur Ridge, I am informed by Murray Petrie (Vineyard Manager, McArthur Ridge Vineyard) that about two thirds are processed outside the region (mainly in Marlborough). This leaves about one third to be processed in the region.
 - (ii) The wine revenue is an estimate based on:
 - (A) 680 litres of wine per tonne.
 - (B) Average wholesale price of \$134 per case or \$11.15 per bottle.

63 As the NZ Wine Industry is largely an export focused industry, there are economic benefits from the McArthur Ridge development at the national level. As all the production from the McArthur Ridge vineyards is processed in to premium wine, all with the potential to be exported, the annual export value (FoB) that could be generated from an average season is calculated:

- (a) \$8.35million (174 ha x 7.37 t/ha x 680 l/t x \$9.58¹ per l exported).

¹ NZ Winegrowers April 2023 Export Statistics

- (i) This calculation is based on:
 - (A) 174 ha: The producing area of vineyard at McArthur Ridge.
 - (B) 7.37 t/ha: The average yield of vineyard over the last ten seasons.
 - (C) 680 l/t: Extraction rate of finished wine volume per tonne of grapes harvested.
 - (D) \$9.58 per l: Average FoB value of all bottled NZ wine exported. I would expect exported Central Otago Pinot noir to earn more than the average, so this figure has under-estimated the value.
 - (1) If \$12 per bottle FoB was achieved this would increase the FoB earnings to \$15.83 per l and a total of \$13.8 million.
 - (b) A proportion of the wine produced will be sold in the domestic market throughout NZ, but the export value of the total volume will capture this contribution.
- 64 The vineyard irrigation infrastructure is modern with some of the best available technology and approaches to optimise the application of water to support the commercial endeavour of growing grapes for winemaking clients.
- (a) The vineyard water requirements are met by a combination of direct take from the Manuherikia Irrigation Scheme and water that has been stored in a series of three dams (combined storage volume of 361,834 m³). The dams buffer the periods when water is not available from the scheme and, more importantly, when frost mitigation is undertaken because the peak demand for water is greater than the direct supply is able to deliver.
- 65 Frost mitigation (mainly in the spring and early summer, but also infrequently in the late autumn) is provided by a network of overhead

sprinklers that are operated simultaneously. This is the only viable option of frost mitigation in this location because:

- (a) About half of the frost events every season do not have well developed or reliable warm air inversion layers rendering helicopter or frost fans ineffective.
- (b) Also, some of the cold temperatures exceed the 0 to -4°C range that air movement can be effective at frost mitigation. Murray Petrie reports that the McArthur Ridge vineyard development has operated their sprinklers protecting the vines down to -8°C.

66 The water application volumes are large as the whole vineyard is being wet at the same time.

- (a) The pumps on this vineyard deliver about 3,000 l per sec for frost mitigation. This is in the order 5.5 mm per hour.

67 Annual water use over the last 13 seasons was provided by Murray Petrie, the vineyard manager at McArthur Ridge based on measured volumes via flow meters.

- (a) For the vineyard presently planted, the 2013-2014 season had the highest water use for irrigation of 527,523 m³. This is equivalent to about 1000 l of water per vine for the whole season. This figure is typical of vineyards growing in dry climates.
- (b) Three seasons, 2012-2013, 2015-2016 and 2018-2019 required similar volumes of water for frost mitigation, the highest over the 16 years of records. This was in the order of 4,620 m³ per ha or 84 hours of frost mitigation per season.

68 Application of water for frost protection has an impact on the amount of water used for irrigation.

- (a) The water applied for frost protection offsets the amount of water required for irrigation, particularly in the spring. So, in seasons with more frost mitigation, particularly if the frost mitigation is well into late spring early summer, then typically less water is required for irrigation.

- 69 Soil and vine monitoring are utilised to optimise the water used. Rather than a calendar based irrigation regime the irrigation is managed to match the daily water requirements and the available water at that time.
- 70 Other approaches McArthur Ridge Vineyard uses to optimise the water use are:
- (a) McArthur Ridge Vineyard budgets to apply 300 tonnes of compost mulch along the vine row to enhance the soil organic matter improving the water holding properties of the soil creating:
 - (i) Less runoff of both rain and irrigation water
 - (ii) Better water absorption and retention
 - (iii) Better water release dynamics.
 - (b) Years of experience, detailed monitoring and modern technology are utilised at McArthur Ridge vineyard development to optimise the water use during both frost mitigation and irrigation. Pumping costs are high and optimising the water application results in optimising the pump use and cost of pumping for the grapegrowing business.

Impact of Changes to Water Consents

- 71 Any proposed changes to the way water is consented for Central Otago needs to consider:
- (a) Water use by vineyards is distinctly different to other agricultural industries.
 - (i) This has been recognised with separate provisions by other Regional and District councils where vineyards are a significant land use.
 - (b) Water is critical for the sustained production of premium wine grapes.
 - (i) For supplementary irrigation to support yields and wine quality.

- (ii) Frost mitigation to secure reliable cropping performance and vine survival.
 - (c) Water supply needs to be reliable and of sufficient volumes to meet the peak demands during the growing season and under drought conditions.
- 72 With the situation of over-allocation of consented water for irrigation, an approach to apply a “sinking lid” across all irrigation users to reduce the allocation does not make sense when there is a range of efficiencies and variation in how direct impacts of water shortages effect these uses. Vineyards are efficient water users and the vines have little elasticity or resilience to tolerate periods of sub-standard volumes of irrigation water.
- 73 I have read Richard Johnson’s evidence (23 June 2023) that comments on planning and policy considerations for water allocation and concludes:
 - (a) Vineyards should be treated differently to other primary land uses.
 - (b) Recognition of vineyards being treated separately would then align with the approach taken in Marlborough and Hawkes Bay Regional Environment Plans.

Dated: 27 June 2023



Dr David Talbot Jordan