Before the Central Otago District Council

In the matter	**The Resource Management Act 1991**
And	**A requested change to the Central Otago District Council's Operative District Plan – Plan Change 13 (PC13)**

Statement of evidence of James Dicey for the Central Otago Winegrowers Association Incorporated

20 May 2019

Statement of evidence of James Dicey

1 Introduction

1.1 My full name is James Dicey.

1.2 I am the owner of Grape Vision Limited, a vineyard development, management, brokerage and consultancy business based in Central Otago. I have been involved in the grape and wine industry since 2004.

1.3 I hold a Bachelor of Commerce (1992) and Bachelor of Law (1993) from Otago University and a Graduate Diploma in Oenology and Viticulture from Lincoln University (2005). A copy of my curriculum vitae is attached to this statement of evidence as **Appendix 1**.

1.4 Originally I qualified as a Chartered Accountant gaining experience with Deloitte in New Zealand, Amsterdam and London, prior to working as an independent contractor. My last contractor role was as a financial and IT risk manager with Diageo plc, a British multinational alcoholic beverages company that produces spirits, beer and wine.

1.5 I joined Grape Vision Ltd as an operations manager in 2004 upon moving back to New Zealand. After gaining a Graduate Diploma in Oenology and Viticulture, I continued to work for Grape Vision Ltd before purchasing the business in 2009.

1.6 Through my work with Grape Vision Ltd I have accumulated extensive experience and expertise in the development of vineyards and the production of grapes grown for both clients and myself. Since 2004, I have managed between 250 and 400 hectares of vineyard land in the Central Otago winegrowing region including the following properties close to the land that is the subject of PC13:

(a) Highlands Motorsport Park vineyard (immediately adjacent to PC13);

(b) Serendipity Vineyard (on Ripponvale Road);

(c) Inket Vineyard (on Pearson Road);

(d) A large number of vineyards in Bannockburn.

1.7 I have also consulted in other New Zealand wine regions, as well as in South Africa and California. I also consult to the Queenstown Lakes District Council regularly on reverse sensitivity issues caused by property development.

1.8 I have previously appeared as an expert witness during arbitration, at the District Court and in the Environment Court.

1.9 Additionally, I have gained a detailed business and economic understanding of the Central Otago wine industry through owning my own brand (Ceres Wines Limited) and through my role as director of Mt Difficulty Wines Limited, a position I have held since 2004 until the company was sold on 3 January 2019.

1.10 Other positions I have held in the wine industry include:

(a) committee member of the Central Otago Winegrowers Association for over 12 years, including as President for over five years;

(b) sitting on the New Zealand Winegrowers Research Committee for four years;

(c) being an elected Director of New Zealand Winegrowers Incorporated, the New Zealand wine industry member body, since 2016 (including deputy chair roles on the Finance and Sustainability committees); and

(d) being a nominated Director of New Zealand Winegrowers Research Centre Limited (since its inception in 2017), a wholly owned subsidiary of New Zealand Winegrowers which instigates and oversees research.

1.11 I am a resident of Cairnmuir Road in Bannockburn and a member of Highlands Motorsport Park. I am not financially affected by PC13. The evidence in this document is presented in my capacity as an expert witness, I have also made submissions on PC13 in my capacity as a resident of the district and these will be presented on verbally at the hearing.

2 Code of conduct for expert witnesses

2.1 I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2014 and that I have complied with it when preparing my 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.

3 Scope of evidence

3.1 Generally, my evidence addresses:

(a) the viticultural attributes of the PC13 site;

(b) the productive potential and viticultural viability of the PC13 site;

(c) economic viability of the PC13 site from a viticultural perspective; and

(d) the potential effects of the Proposal, if consented, on viticultural activities both on the PC13 site itself and on nearby sites.

3.2 I have visited the site and the wider area, and have also considered various documents that I consider to be relevant to this matter. A full list of the documents I have reviewed and considered are set out at **Appendix 2** to my evidence.

3.3 My evidence is structured as follows:

Part 4: Executive summary

Part 5: The productive potential and viticultural viability of the site

Part 6: Economic viability of the PC13 site from a viticultural perspective

Part 7: Effects of the proposal on the orchard

Part 8: Conclusion

4 Executive summary

4.1 My evidence outlines that:

(a) From a viticultural perspective, the PC13 site is productive land. Economic quantities of high quality grapes can be fully ripened on a consistent basis. The climate and soils make the site suitable for wine

production and the wines that are produced from these grapes will have a distinctive sense of place and the potential to command international acclaim.

(b) The establishment and operation of a commercial winegrowing operation at the PC13 site is economically viable. Such an operation has the potential to command a price commensurate with the yield/quality tier of the grapes grown.

(c) When solely considered as a contract grape growing vineyard, the majority of yield and price scenarios examined result in a satisfactory Return On Investment (**ROI**). In my opinion, the location of the site lends itself to capturing additional value using successful business models that progress further along the value chain, particularly in relation to the Direct to Consumer and tourist business models.

(d) The Proposal will result in the loss of productive viticultural land.

(e) The Proposal will result in reverse sensitivity effects relating to noise, spray drift, tractor and staff activity. Reverse sensitivity no complaint clauses are not sufficient to mitigate these effects.

5 The productive potential and viticultural viability of the PC13 site

5.1 When considering the productive potential and the financial viability of a site it is necessary to assess the suitability of both the soil and the associated climate. Soil by itself is only part of the assessment. For the reasons discussed below, I consider that the climate and soils make the PC13 site a very suitable site for wine production. The PC13 site receives some of the highest GDD in the Cromwell basin as shown in **Appendix 4**, as well as some of the lowest rainfall levels, as shown in **Appendix 5**. When compared to other parts of the Central Otago wine growing region, the frost risk on the site is also reduced due to lower altitude. The soils at the site are suitable for viticulture and have the potential to achieve full ripeness and create distinctive and high quality wines.

Site visit

5.2 I have visited the PC13 site in the past, prior to the current ownership by the proponent. I have driven and walked within the site, and examined it from the boundaries. In addition to this visit, I have also observed the site over the years that I have been growing grapes at the Highlands Motorsport Park vineyard and in the Central Otago winegrowing region (2005 to the present). Based on my site visit and my general knowledge of the site, I make the following observations:

(a) The upper terrace of the site is largely flat with a gentle slope to the South with a marked escarpment that runs South-West/North-East and is then largely flat on the lower terrace, again with a gentle slope to the South before rising with a smaller escarpment on the southern boundary. Using Google tools, I have estimated that the altitude of the vineyard ranges 233 meters above sea level (**masl**) for the top terrace and 221 masl for the bottom terrace.

(b) The site is not within a katabatic zone (meaning cold air does not drain onto the property) but there will be an onsite drain of cooler air onto the bottom terrace.

(c) Apart from the escarpment which divides the two terraces the balance of the PC13 site is productive land able to be planted as a vineyard. I have estimated using Google tools that 33.7ha is plantable and at an 85% recovery (to account for headlands and curtilage areas) this equates to 28.6 ha planted. This data is presented in **Appendix 6**.

Accumulated heat

5.3 Accumulated heat is a measure of how much heat a grapevine receives during the growing season (above a baseline of 10°C) and is a key consideration when considering the viticultural viability of a site. Growing Degree Days (**GDD**) is the calculation used to measure accumulated heat.

5.4 There is a GDD range which is optimal for economic yields and ripeness to be achieved. For the varieties grown in the Central Otago winegrowing region, this spans from 750 – 1200 GDD. The PC13 site experiences 951-1000 GDD on the top terrace and 1001-1050 on the bottom terrace according to the GrowOtago

resource (which interpolates GDD based on climate modelling and mapping techniques). This data is set out in **Appendix 4** to my evidence.

5.5 No weather station data is available from the PC13 site. However, data from the HarvestNZ data from Bannockburn and Suncrest Orchard (which is immediately to the West of the top Terrace) indicates that the PC13 receives sufficient GDD to properly ripen grapes. The GrowOtago data referred to above is included as **Appendix 4** to my evidence and the HarvestNZ data is included as **Appendix 3**.

5.6 An external data source in regard to sugar ripeness and its relationship to accumulated heat in the PC13 site is the VineFacts 2018 data collected by New Zealand Winegrowers. This data shows that, in the last five years, the VineFacts site in Bannockburn achieved sufficient sugar ripeness (well over the industry standard sugar ripeness rejection standard) to commercially harvest the fruit.

5.7 An additional consideration when considering accumulated heat is the altitude that the vineyard is located at. Within the Central Otago winegrowing region, it has been generally accepted that 400masl is the upper limit to successfully ripen grapes and, at between 221-233masl, the PC13 site is below this upper limit.

Rainfall

5.8 Rainfall data from the GrowOtago resource indicates that the PC13 will receive between 451 and 550mm of rain per annum. This is a rainfall equivalent to other areas of the Central Otago wine growing region. I note that this rainfall is typically spread across the year and will require irrigation, like all other grape growing areas of the Central Otago wine growing region.

Frost

5.9 It is widely accepted in the grape growing industry that a frost during the growing season can damage the cell tissue of leaves and fruit, and lead to crop loss. It can also compromise vine performance in the following season. All of the Central Otago winegrowing region is subject to frost risk of varying degrees. While this can be partially mitigated by methods such as site selection, wind machines, helicopters or water, none of these completely eliminate the risk from all frost events.

5.10 In the absence of weather data specific to the PC13 site I rely on my experience and data from the neighbouring Suncrest Orchard HarvestNZ weather station data which indicates that the upper terrace of the PC13 site should receive adequate frost mitigation from wind machines, which can protect the grapes in a frost as cold as -2°C. The lower terrace of the PC13 site will, due to its topography, receive more frost events and when they occur they will be deeper and potentially more damaging. This is due to the pool of cooler air during a frost event on the lower terrace. As the site does not have weather data monitoring records I am unable to conclusively state whether this will able to be mitigated by a wind machine or whether water frost fighting will be required (which will provide protection to -5°C). Water frost fighting requires an adequate water right to supply sufficient water for the sprinklers.

Vines

5.11 Different grape varieties require different environmental conditions to ripen economic yields. A range of varieties are suitable for growth on the PC13 site. The predominant variety grown in the Central Otago winegrowing region is Pinot Noir, although Pinot Gris, Gewürztraminer, Chardonnay and Riesling should also perform well.

5.12 Fruit grown in the Cromwell Basin, Ripponvale area and Bannockburn have achieved numerous national and international gold medals and trophies. The region has firmly established itself internationally as a region that grows great Pinot Noir.

Wind

5.13 During the growing season wind gusts can damage the vine canopy and reduce the speed of ripening. Vineyards which are subject to lower velocity gusts of wind are at less risk of damage to shoots and grapes and are better able to ripen higher yields. Data from the GrowOtago resource suggests the site is subject to a lower average annual maximum wind speed compared to other vineyards in the Central Otago wine growing region. The GrowOtago data referred to above is included as **Appendix 8** to my evidence.

The size of the PC13 site

5.14 Analysis of the New Zealand Winegrowers Vineyard Register Report 2018 indicates that the average size of vineyards in the Central Otago winegrowing region is 8.7 hectares. In my experience larger sites are more economically viable. As such a site the size of PC13 at 28.6 ha planted hectares should be more economically viable than similar smaller sites in the Central Otago Winegrowing region.

Soil

5.15 Soil provides the nutrients and holds the water that grapevines need to grow. Different soils have different physical, biota and chemical characteristics and this variation contributes to differences in the wines that are produced from grapes grown on them. Differences in soil characteristics contribute to different wine styles and these differences are a valued by growers and makers.

5.16 In my experience the soils of the PC13 site are suitable for viticulture. There are a range of different soils in the Central Otago wine growing region which, in my opinion in combination with the other factors described in this section of my evidence, result in wines with a distinctive character and sense of place. It is a combination of both the yield and this distinctive character which contribute to the value ascribed to grapes grown in Central Otago.

5.17 The soils on the site are described in the GrowOtago resource generally as Molyneux soils under the New Zealand Soil Classification. These soils are shown in **Appendix 7**. I generally agree with the analysis of Mr Hill in his paper based analysis of the soils of the PC13 site, but I do note that he has not visited the site and has done no field soil analysis or on-site Land Use Capability Classification. I also note that the soil mapping data available in NZ, as referred to in the Land Use Capability Survey Handbook (3rd Edition) is "patchy and varies in age, scale and quality". Reliance on this data to draw a definitive conclusion, as he appears to have done regarding whether the soils on the PC13 site are high class soils, is inadequate and may lead to inappropriate conclusions being drawn.

5.18 According to paragraphs 39(b) and 39 (c) of Mr Hills evidence it is the depth of soil being >45cm to the gravels that dictates whether the soils are LUC Class 3s or not. In the absence of actual on site soil analysis I propose that the evidence proposed by Mr Hill has extremely limited value in the absence of such an

analysis. According to the definition contained in the Central Otago District Council Operative District plan high class soils are not limited to particular classes:

'High class soils' means soils that are capable of being used intensively to produce a wide variety of plants including horticultural crops. This definition requires good soil and other resource features that combine to be capable of producing a wide range of crops. It does not include areas that may be suited for one or two specialist crops, largely due to the climate rather than soil quality.

5.19 When tested against this definition the soil on the PC13 site should be considered to be high class as they have the potential to grow a range of crops, not only the range of different tree crops on the Suncrest Orchard but also vineyards. I have successfully grown grapes on a number of Molyneux soils in relatively close proximity which experience a similar climate. These include the following vineyards (which are identified on **Appendix 7**):

(a) Highlands Vineyard

(b) Inket Vineyard

(c) Mansons Farm Vineyard

(d) Eliza Vineyard

(e) Cameron Vineyard

(f) Bannockbrae Vineyard

5.20 From a viticultural perspective the Molyneux soils are valued for their lower water and nutrient holding capacity which enables vigour to be controlled and balance between reproductive and vegetative growth achieved which is a desirable trait when growing quality grapes.

5.21 Currently there is a shortage of viticultural land available on the market and what land has been available is subject to competing rural uses as either cherries and dairy support (depending on sufficient water being available) or urban use as lifestyle blocks.

5.22 The loss of sites such as PC13 will reduce *"the primary productive capacity of Otago's existing high class soils to meet the reasonably foreseeable needs of future generations and the avoidance of uses that have the effect of removing those soils or their life-supporting capacity and to remedy or mitigate the adverse effects on the high class soils resource where avoidance is not practicable."* (Otago Regional Council Partially Operative Regional Policy Statement, section 5.5.2). In my opinion, simply looking at soil classifications and only valuing "high class soils" without considering what can effectively be grown on them in the Central Otago climate will exclude protection from soils which are very suitable for viticulture. In my experience high quality grapes can be very successfully grown on LUC Class 4-7 soils with few limitations and this is also acknowledged in the Land Use Capability Survey Handbook (3rd Edition, p9).

6 Economic viability of the PC13 site from a viticultural perspective

6.1 It is my opinion that, from a viticultural perspective, the PC13 site is economically viable. It has the potential to grow high quality, fully ripe grapes at sufficient yields and will be able to command a price commensurate with the yield/quality tier the site will be able to generate.

6.2 The site should not just be considered from its ability to grow multiple crops (the essence of versatile or high class soils) but for its ability to generate a positive return and contribute to both jobs and the local economy. Vineyards play a significant role in the Central Otago region, contributing over 600 full time equivalent positions. The wine produced from the Central Otago wine growing region has been estimated as having a trade value of $185 million. Losing this land will remove the property from being able to generate a net economic return for the region. This section considers the economics of growing grapes in the Central Otago wine growing region.

6.3 When solely considered as a contract grape growing site, the majority of yield and price scenarios I have experience with generate in a positive ROI. The location of the site on State Highway 6 lends itself to capturing additional value using successful business models that progress further along the value chain, particularly in relation to the Direct To Consumer (**DTC**) and tourist business models through vertical integration. In my opinion, the site also has the potential to generate a positive capital gain.

Vineyard Models

6.4 Commercial vineyards have been located in the Central Otago wine growing region since the early 1980s when Alan Brady planted his vineyard in the Gibbston. Almost from the start of viticulture in the Central Otago wine growing region, different business models have been adopted to generate an economic return. To conclusively assess whether a site is economically viable from a viticultural perspective each model should be considered. Other considerations of economic value includes understanding the ROI that can be generated from business models which travel further down the value chain, as this has can generate significantly better returns.

6.5 Broadly, business models in the Central Otago wine growing district have broadly included:

(a) Contract grape growing;

(b) Vineyard lease;

(c) Bulk wine;

(d) Wines sold direct or via a distributor to the trade;

(e) Wines sold direct to the consumer; and

(f) Tourism and other activities leveraged off the wine business (bike rental, cheese stores, restaurants, vineyard accommodation etc).

6.6 The vast majority of vineyards are winery owned (although I am not sure of the exact percentage). This demonstrates that across the whole of the Central Otago winegrowing region, pursuit of additional value is key and the pure contract growing model should not be the only manner in which the economic value of viticulture should be assessed.

6.7 I note that there are many combinations of these business models in the Central Otago wine growing region but, for the purposes of my evidence, focus on each of the main models.

Contract Grape Growing

6.8 Contract grape growing is growing grapes for sale to generate a profit from the vineyard. The economics of this business model are driven by the combination of vineyard productivity, price and the cost of production to calculate profitability.

6.9 In my opinion, the site has attributes that are equal to, or superior than, other Central Otago vineyards when solely considered as a contract growing vineyard. Specifically, these attributes include higher GDD, lower rainfall, equal or reduced frost risk, suitable soil, lower average annual maximum wind speed, the ability to be planted with modern clonal material and sufficient size when compared to most other Central Otago vineyards. As a result, the site has the opportunity to generate a positive ROI as a contract growing vineyard.

Vineyard Productivity in the Central Otago wine growing region

6.10 Based on my experience from growing grapes in the Central Otago wine growing region on a range of sites, the following quality and yield tiers apply to the Central Otago wine growing region:

Quality Tier	**Cromwell Basin Yield Range**
Value (RRP $25-$30/btl)	7-8t/ha (Avg 7.5)
Premium (RRP $35-$45/btl)	5.5-6.5t/ha (Avg 6)
Icon (RRP $65+/btl)	3.5-4.5t/ha (Avg 4)

Pricing

6.11 There is a direct relationship between yield, quality and the prices the grapes command. Different quality grapes are priced at different levels that reflect their quality.

6.12 Demand for Central Otago grapes is currently strong. As part of my business I regularly field requests for grape purchases and in the 2018-19 season had well over 400t of opportunities for purchase of Pinot noir that I was unable to fulfil from all sub-regions.

6.13 Major global companies such as Constellation Brands, Treasury Wine Estates and Louis Vuitton Moët Hennessy have purchased or developed vineyards in the

Central Otago winegrowing region to ensure they can secure continued supply of grapes.

Demand growth is also shown when the trend in average price for grapes is examined, including a rising premium for Central Otago compared to the NZ price for Pinot Noir. In my opinion, given its attributes, it is reasonable to assume that the site will be used to grow Premium quality fruit.

6.14 Data from New Zealand Winegrowers is available in $50 price increments (as set out in **Appendix 10** to my evidence) which reflects the pricing typically used in Central Otago. These data shows the stretch around the median price and tiered pricing. Additionally, in my experience in recent years, spot priced fruit on the open market has been significantly higher than the average price with most recent pricing being in the ranges outlined below:

Quality Tier	**Price Range**
Value (RRP $25-30/btl)	$3,650 – $3,850 (Avg $3,750)
Premium (RRP $35-45/btl)	$3,850 – $4,250 (Avg $4050)
Icon (RRP $65+/btl)	$4250+

The following income matrix shows the full range of potential revenue per hectare using different fruit quality, taking into account a range of yields and pricing. This income range can then be compared to costs of production to gain an understanding of potential profit:

		Pricing		
		Value	Premium	Icon
Yield		3750	4050	4250
Lower	4	15000	16200	17000
Average	6	22500	24300	25500
Upper	7.5	28125	30375	31875

Profitability

6.15 The price per hectare to grow the grapes in the in Central Otago (called the Costs of Goods Sold or COGS) also has a range. Comparing the COGS to revenue results in the following per hectare profitability matrix:

COGS	Profitability

Lower	15500	-500	700	1500
		7000	8800	10000
		12625	14875	16375

Middle	16700	-1700	-500	300
		5800	7600	8800
		11425	13675	15175

Upper	21000	-6000	-4800	-4000
		1500	3300	4500
		7125	9375	10875

6.16 In summary, the above analysis shows that a range of returns are possible and that it is possible to cover the costs of production and other off-vineyard costs. This will provide a positive return in ~78% of the scenarios considered and, in my opinion, is an acceptable ROI.

Capital gain as a method of calculating return on investment

6.17 Another dimension of ROI is the likely capital gain that will be achieved by redeveloping the vineyard. Developed and producing grafted vineyards are valued between $185,000 and $220,000 per hectare. At the more modest range this equates to a capital gain of between 31% and 146% based on the data and calculation contained in **Appendix 9**.

Vineyard lease

6.18 A vineyard lease is an alternate contract grape growing business model. It effectively transfers control and most of the risk to the lessee. In exchange, a lower return to the lessor is offered. Leases typically generate returns of between 2-4% of capital value and I am aware of a number of vineyard leases in the Central Otago wine region which are generating this range of return. This is a relatively risk free option for generating returns and would still enable the lessor to benefit from capital gain.

Bulk wine

6.19 This model looks at making the grapes into bulk wine which is then sold. In my experience, there is currently strong demand for Central Otago bulk wine. I

have developed a scenario for the PC13 site to test the economic viability of bulk wine sales. This scenario is set out in **Appendix 11** to my evidence. Analysis of the scenario shows selling grapes from the PC13 site as bulk wine would be likely to achieve around an 8% return.

6.20 I also note that the pricing for wine making in the model is based on the assumption that a winery is built on the PC13 site. However, if this does not occur, the wine making price would increase from $2.50 a litre to $3.20 a litre (which is the current commercial cost of wine making on contract). Running the scenario on this basis would drop the return to 0.6% which is an unacceptably low return and demonstrates the value of building a winery on the PC13 site.

Wines sold direct using a sales manager or via a distributor to the trade

6.21 The majority of wineries in the Central Otago wine growing region include a component of the business model where branded bottled wine is sold directly to the wine trade directly (**direct sale**) by an employed sales manager or via a distributor (**distributor model**).

6.22 I have developed two scenarios for the PC13 site to test the economic viability of wine sold in this manner. The scenarios and my calculations are set out in **Appendices 12** and **13** to my evidence. The scenarios presented show all the wine produced at the PC13 site in one year sold direct to trade customers either by an employed sales manager or via a distributor. The models that I have produced exclude indirect overhead costs (administration, tax, depreciation, debt servicing, rates, accountancy fees etc) but in my opinion do include all likely direct costs.

6.23 From the models that I have developed, I consider that the estimated returns for direct sales from the site could range significantly from 35% for distributor to 51% for a direct to trade model (or 32% for distributor to 48% for a direct to trade model if no winery building is constructed on site, which I estimate to increase winemaking costs to $3.20 a litre). The returns in these models is commensurate with my direct experience with other wine businesses. Performing a break even analysis, yields would need to drop to below 2t/ha before this business model became uneconomic.

Wines sold direct to the consumer

6.24 The DTC model is viewed in the wine industry as the optimal business model due to its profitability, and is typically predicated on access to a large number of visitors via a cellar door. The 2017 Deloitte Wine industry benchmarks and insights report specifically noted that the Central Otago winegrowing region contains an almost equal number of wineries and cellar doors as Marlborough, despite only producing ~2% of the national production of grapes (compared to Marlborough's ~79% of production).

6.25 Data from the New Zealand Tourism Forecasts 2018 – 2024 indicates that tourist numbers to New Zealand are expected to increase 37.1% and spend is expected to increase by 39.7%. Using data I have accessed from Tourism New Zealand I have calculated that the PC13 site will see an increase of over 73,000 wine tourists by 2024 which will in turn present an enhanced DTC opportunity.

6.26 I have developed the scenario at **Appendix 14** to my evidence, which assumes 100% sales to consumers and 3.5 Full Time Equivalent staff to host and prepare platter food to enable an on premise license. Food is assumed to be zero margin so is excluded from calculations. This model shows a very healthy return on investment of 65% (or 64% if the wine is made on contract for $3.20 a litre and the building is only used as a cellar door). A breakeven analysis using this model indicates that yields would need to drop to below 1t/ha before becoming uneconomic. The model also excludes ongoing direct sales from customer data collected at the cellar door, website sales, merchandise sales, private cellar door tastings, wine clubs etc which can contribute significantly to profitability.

6.27 A number of the brands in the Central Otago winegrowing region have established cellar door operations in the Central Otago win growing specifically for the purpose of DTC sales.

Tourism and other activities leveraged off the wine business (functions, bike rental, local produce, restaurants, vineyard accommodation, etc)

6.28 Other activities can be vertically integrated from the winery/tasting room and this provides an opportunity to generate additional profit. For example, bike park (Gibbston Valley), Restaurant (Gibbston Valley, Waitiri Creek), functions (Peregrine, Gibbston Valley, Waitiri Creek, Winehouse), brewery (Waitiri Creek),

local produce (Gibbston Valley), vineyard accommodation (Peregrine, Kinross), wine cave (Gibbston Valley), pub (Rockburn).

7 Effects of the proposal on the Suncrest orchard

7.1 This section of my evidence addresses the reverse sensitivity effects on the proposed residential activities from the neighbouring Suncrest orchard. The reverse sensitivity issues with vineyards and orchards are materially the same, so I believe that I am qualified to express my expert opinion. I live on a vineyard and experience the adverse effects of the agrichemicals regularly during the growing season – this does not result in a reverse sensitivity issue I have chosen to live on my vineyard as the land owner.

7.2 I have confirmed with the orchard manager statements I have made in this section. My evidence addresses reverse sensitivity issues relating to spray drift and noise from the orchard to the residential properties. For the reasons listed below, I am of the opinion that locating residential properties contiguous to an operating orchard will result in reverse sensitivity effects that will not be easily mitigated against without appropriate buffer zones and planting a shelter belt prior to development commencing.

Spray drift

7.3 In my experience, the placement of residential activities proposed by PC13 in close proximity to an operational orchard is likely to result in reverse sensitivity effects. The most significant of these is related to spray drift. Spraying agrichemicals is an activity regularly performed during the year to effectively prevent or eradicate pest and diseases in orchards and vineyards. Agrichemicals are discharged to air and are a permitted activity under the Otago Regional Council Air Plan (16.3.9.2), providing:

(a) *The agrichemical and any associated additive are authorised for use in New Zealand and are used in accordance with the authorisation; and*

(b) *The discharge is carried out in accordance with the manufacturer's directions; and*

(c) *The discharge does not exceed the quantity, concentration or rate required for the intended purpose; and*

(d) *The application does not result in any ambient concentrations of contaminants at or beyond the boundary of the property that have noxious or dangerous effects.*

7.4 The management of effects of spray drift in the Otago Regional Council Air Plan is based on NZS 8409:2004 Management of Agrichemicals (the **Standard**). The Standard sets out the practical and specific guidance on the safe, responsible and effective management of agrichemicals. Conforming to this standard may also satisfy the requirements of the Resource Management Act and the requirements of the Otago Regional Council Air Plan. Section 5 of the Standard outlines the requirements and guidelines for the application of the relevant fungicides.

7.5 Suppliers and users are required to manage any risks associated with the use of Fungicides. Responsibilities depend on the user category (supplier or user) and the hazards associated with the agrichemical being used. The Standard sets out several responsibilities for the user, which include:

(a) *Obtaining from the supplier all information necessary to enable safe use of the product;*

(b) *Taking note of the information provided and taking appropriate action to manage risks;*

(c) *Suitable procedures to ensure adequate notification of the intention to undertake agrichemical application where that is required;*

(d) *Proper procedures and contingency plans to handle adverse events;*

(e) *Proper storage, documentation, mixing, application equipment, and disposal;*

(f) *Decisions on the continuation or cessation of field operations (for example, if there is exposure to persons not involved in the operation or spray drift outside the target area);*

(g) *Compliance with all relevant local authority plans.*

7.6 The Standard states that in all cases the person applying agrichemicals must be appropriately qualified and familiar with the requirements of the Standard and any relevant local authority air plan. In terms of managing off site effects, the Standard provides for the notification of anybody who is likely to be directly affected by the application of agrichemicals, and for the minimisation of spray drift.

Notification

7.7 Anybody who is likely to be directly affected by the application of agrichemicals has a right to the information about the operation. The Standard provides for the provision of an Agrichemical Spray Plan on at least an annual basis. Prior notification should be given where agrichemicals are applied next to dwellings.

7.8 In my opinion this requirement will become an onerous and ultimately impractical and unachievable requirement with a high number of residential neighbours. Given the vagaries of weather in Central Otago, particularly in relation to wind, a significant degree of flexibility is required to enable timely application of agrichemicals – this may involve starting at early hours where notification is not practical or amending the spray timing to take advantage of calm weather. With the number of residential properties proposed on the PC13 site, the notification requirement will compromise the ability to effectively farm the orchard as complete notification of all residential properties will be unable to be effectively and efficiently completed in a reasonable time.

Spray Drift

7.9 Spray drift can occur as either primary drift (movement of spray as fine droplets directly from the application equipment) or as secondary drift (movement of spray contaminated dust, soil or sand particles and movement of spray as vapour). The applicator is responsible for primary drift because it occurs at the time of spraying and the means of minimising primary drift are largely within control of the applicator. The applicators must identify sensitive areas (which includes residential properties) and the spray plan must identify measures to be taken to avoid the drift hazard.

7.10 Hazardous substances in New Zealand are grouped into nine classes depending on their hazardous property (which can be more than one). Class 6 substances are toxic to people and Class 9 substances are toxic to the environment. I have been in contact with the orchard owner of the neighbouring orchard and the following chemicals are permitted to be used that have class 6 or class 9 ratings:

Chemical trade name	**Purpose**	**Class**
Alto	Fungicide	6.4A, 6.8A, 6.9B, 9.1A, 9.3C
Botran	Fungicide	6.1D, 6.4A, 6.9B, 9.1A, 9.3C
Apollo	Miticide	6.9B, 9.3C
Bravo	Fungicide	6.1B, 6.3B, 6.4A, 6.5B, 6.7B, 6.9A, 9.1A, 9.2B,

		9.3B
Chorus	Fungicide	6.1E, 6.9B, 9.1A
Copper	Fungicide	6.1D, 6.4A, 6.5B, 6.9B, 9.1A, 9.3C
Folicur	Fungicide	6.4A, 6.9A, 9.1A
Pyrinex	Insecticide	6.1C, 6.3A, 6.4A, 6.8B, 6.9A, 9.1A, 9.2B, 9.3A, 9.4A
Malathian	Insecticide	6.1D, 6.3B, 6.4A, 6.8B, 6.9A, 9.1A, 9.3B, 9.4A
Mavrik	Insecticide	6.1D, 6.9B, 9.1A, 9.3C
Megastar	Fungicide	6.1D, 6.3B, 6.4A, 6.7B, 6.8A, 6.9A, 9.1C, 9.3C
Mit E Mec	Miticide	6.1E, 6.3B, 6.4A, 9.1A, 9.2C, 9.3C, 9.4B
Mizar	Fungicide	6.1D, 6.4A, 6.5B, 6.9B, 9.1A, 9.3C
Octave	Fungicide	6.1E, 6.4A, 6.9B, 9.1A, 9.3C
Omite	Miticide	6.1D, 6.4A, 6,7B, 6.1E
Captan	Fungicide	6.3B, 6.5B, 6.7B, 9.1A
Pirimor	Aphidicide	6.1C, 6.1D, 6.3B, 6.4A, 6.9B, 9.1A, 9.3A, 9.4B
Pristine	Fungicide	6.1D, 6.9B, 9.1A
Protek	Fungicide	6.5B, 6.6A, 6.8A, 6.9B, 9.1A, 9.2B
Rovral	Fungicide	6.9B, 9.1A
Saprol	Fungicide	6.1E, 6.3A, 6.4A, 6.8A, 6.9A. 9.1D, 9.3C
Score	Fungicide	6.1E, 6.3A, 6.4A, 6.8A, 6.9B, 9.1A
Sevin Flo	Insecticide	6.1C, 6.7B, 6.9B, 9.1A, 9.2B, 9.3B, 9.4A
Sumisclex	Fungicide	6.8A, 6.9A, 9.1A
Thiram	Fungicide	6.1B, 6.1C, 6.4A, 6.5B, 6.9B, 9.1A, 9.3B
Topsin	Fungicide	6.1D, 6.5B, 6.6B, 9.1A, 9.2B

7.11 The codes used in the table have the following meanings:

Class	Explanation
6.1B	May be fatal if inhaled
6.1C	Toxic if swallowed
6.1D	Harmful - may be harmful if swallowed, inhaled or absorbed through the skin
6.1E	May be harmful if swallowed, inhaled or absorbed through the skin
6.1D	Acute Toxicity (Oral)
6.3A	May cause skin irritation
6.3B	May cause mild skin irritation
6.4A	Substances that cause eye Irritation
6.5B	May cause sensitisation from prolonged skin contact
6.6A	Toxic - may cause genetic defects
6.7B	May cause cancer
6.8A	May damage fertility or the unborn child
6.8B	Harmful - may cause reproductive/development damage from repeated oral exposure
6.9A	May cause kidney damage from repeated oral exposure at high doses
6.9B	Specific Target Organ Toxicity
9.1A	Very toxic to aquatic organisms
9.2B	Toxic to the soil environment
9.3A	Substances that are very ecotoxic to terrestrial vertebrates
9.3B	Toxic to terrestrial vertebrates [birds]
9.3C	Ecotoxic to terrestrial vertebrates
9.4A	Toxic to bees

7.12 It should be noted that the risk is at its highest with the concentrated agrichemical. When sprayed on to the orchard it will be diluted with water and the risk will be lower. These agrichemicals are sprayed regularly (>15 times per year) through the year (both during the growing season and during dormancy depending on the type of agrichemical). The users will have appropriate personal protection equipment when handling the concentrated agrichemicals and when they spray they will be in an air conditioned tractor which has activated charcoal filters to remove any chemicals from the air they are breathing. Residents who may be affected by spray drift will have no protection so although the risk from a single application is lower, repeated doses without protection can present significant risk to the residents.

7.13 Mr Brown refers to the Otago Regional Council Air Plan requirements and based on Rule 16.3.9.2 (d) determine that adjoining orchard operations should not be allowed to cross the boundary. As such he concludes that there should be no effects on spray drift on residents. I disagree with Mr Brown's conclusion on the application of Rule 16.3.9.2 (d). In my view the Air Plan anticipates agrichemical discharge to air will result in spray drift and seeks to apply NZS8409 best practice guidance to minimise adverse effects and does not result in noxious or dangerous effects (16.3.9.2).

7.14 The Standard includes Table G1 that summarises the main factors which assist in determining whether spray drift will be a high or low hazard and hence whether it may result in noxious or dangerous effects. The Standard is based on risk management principles where agrichemical users are responsible for managing the risks associated with that use. Spray drift will always result whenever spraying occurs, even if such spraying is being conducted in compliance with the relevant Standards and rules. Table G1 from the Standard is included below:

Table G1 – Drift hazard guidance chart

Potential drift hazard scale			
Factor	**High hazard**	**Low hazard**	**Comment**
Wind speed	Zero/very low (less than 1 m/s) or greater than 6 m/s	Steady (1 – 3 m/s)	Measure or estimate using smoke
Wind direction	Unpredictable	Predictable, and away from sensitive areas	Use smoke to indicate
Humidity	Low (delta T > 8 °C)	High (delta < 4 °C)	Measure, using whirling psychrometer
Atmospheric stability	Inversion layer present	No inversion layer	Use cold smoke to indicate
Maximum height of release of agrichemical	> 1.5 m above the target	< 0.5 m above the target	Application technique See 5.3.4.2
Particle (droplet) size	< 50 microns diameter	> 250 microns diameter	See Q1
Volatility of agrichemical	High (vapour pressure > 10 mPa)	Low (vapour pressure < 0.1 mPa)	Check product label, SDS, or PSC
Sensitive area	Close (< 100 m) away	None, or more than 1 km distant	Identify on property protocol (see M4)
Buffer zone	None	Yes (> 100 m)	Guideline only
Shelter belts	No shelter	Live shelter, > 3 m high and 1 m thick	Not for herbicides
Toxicity	Class 6.1A, B, C, D	Class 6.1E	Check label

7.15 As noted above a number of the agrichemicals are class 6.1B, C or D which are deemed to be high hazard. It is not feasible to remove all these agrichemicals from the annual spray plan as this will compromise the orchards ability to control pests and diseases and to economically farm. I consider that, given the nature of the risks associated with these chemicals, a conservative approach to managing risk from spray drift should be utilised. As the increase in risk is caused by the PC13 proposal the onus to mitigate risk as far as possible within their ambit should be required.

7.16 Although Table G1 indicates that the spray drift of agrichemicals are class 6.1E have a low hazard when all factors are in place to mitigate risk, this does not mean that there is no hazard. The Standard is designed on a risk mitigation basis to address adverse effects. In my opinion, a low hazard may still create an

adverse effect on a sensitive use or with people who are sensitive to a particular chemical. The same applies to the perception of risk, whether real or not. This perception is likely to create complaints. I note that the "no complaints" covenants proposed do not extend to spray drift.

7.17 A sensitive area, which include residential buildings, within 100m of spraying is considered to be a high hazard.

7.18 The Standard provides guidance for when buffer zones are to be used to minimise spray drift hazard to sensitive areas. The width of the buffer zone depends on the application technique, agrichemical used and the physical nature of any shelter belts planted which serve as a physical barrier between the area being sprayed and the sensitive area (being a residential dwelling in this case).

7.19 This is set out in Table G2, which sets out suggested minimum distances between the downwind edge of the target area and the dwelling. This is listed below:

Table G2 – Buffer zones

Application method	**Distance** (metres)	
	With shelter	**Without shelter**
Boom sprayer	2	10
Air blast sprayer	10	30
Aerial application	100	300

NOTE –
These distances are subject to:

(a) The equipment used (boom, air blast, aircraft) being calibrated and operated correctly.

(b) All other appropriate strategies being observed to reduce spray drift hazard (table G1).

(c) Shelter should be complete and without gaps at the base.

7.20 Additional guidance for Table G2 from the Standard is set out below:

G6 Buffer Zones and Shelter Belts

Off-target movement of spray is affected by a large number of interrelated factors including weather conditions, spray characteristics and application technique. A buffer zone between the application site, and a sensitive area may reduce the hazard to that sensitive area. The buffer zone works by allowing the agrichemical to disperse to concentrations low enough not to present a risk (i.e. not exceed any Environmental Exposure Limit (EEL) set). The use of shelter belts to intercept and retain the agrichemical may effectively reduce the width of the buffer zone required. However for herbicides, particularly those used for total vegetation control, live shelter will also be affected by the spray so it will not be useful in those situations.

Other factors that affect the width of a buffer zone include:

(a) Application technique (e.g. projecting spray into the air);

(b) The agrichemical used (e.g. volatility);

(c) The physical nature of the shelter belt.

G6.1 Buffer zone guidelines

It is vital that the guidelines given below are regarded as that – guidelines, which represent the best estimate for three typical application types. Buffer zones, with or without shelter belts, merely provide an opportunity for concentrations of agrichemical to fall sufficiently so that the risk to sensitive areas beyond the buffer zone becomes acceptable (i.e. environmental exposure levels are not exceeded). Depending on the particular circumstances however, there is no guarantee that this can be achieved. Therefore buffer zones are only one of many methods to manage and reduce drift hazard.

Table G2 gives suggested minimum distances between the downwind edge of the target area and the sensitive area. These are for guidance. There are spray droplet drift models that can be used to give more detailed information for specific situations.

7.21 There is no guarantee that a shelter belt will be effective in reducing the risk to a sensitive area to an acceptable level. In my opinion, for the buffer/shelter approach to appropriately mitigate hazard risk, all other factors listed in Table G1 need to be low hazard before becoming an effective risk mitigation. With the permitted use of high hazard agrichemicals as noted above in my opinion a conservative approach to buffer zones should be used, meaning a buffer zone of at least 100m should be used.

7.22 The most common form of application is an air blast sprayer. From discussions with the orchard owner, although they have rarely used aerial application of agrichemicals, they wish to retain the ability to do this in the future. This suggests that even with appropriate shelter the minimum buffer distance needs to be 100m. The proponent in the AEE at 11.4 propose a 5m building setback and a 2m buffer planting (2m at height of planting and at an effective density) and Mr Brown at 4.24 of his evidence has added a solid 3m fence to the River Terrace Resource Area provisions.

7.23 In my opinion this is wholly inadequate and will not sufficiently mitigate adverse effects. The proposal does not specify what variety of trees making their suitability to act as an effective buffer impossible to evaluate (e.g., evergreen

rather than deciduous being a requirement given spraying occurs year round) and a solid fence is not best practise, with the Standard recommending a live shelter.

7.24 The current pine shelter on the orchard does not meet the guidelines for shelter in the Standard. This suggests that the buffer zone needs to be extended to 300m or the proponent needs to plan adequate shelter to reduce the buffer zone to 100m. The guidance in the Standard indicates:

(a) *Natural (live) shelter is more effective than artificial shelter;*

(b) *Shelter should have a minimum thickness of 1m and porosity of approximately 50%;*

(c) *A width to height ratio of about 3.5 is recommended*

7.25 I consider that this shelter needs to be established prior to any residential properties being built to ensure the residential properties are not subject to risk from spray drift.

Restricted Entry Intervals (REI)

7.26 Restricted Entry Intervals is the period that needs to elapse after the application of agrichemicals before staff re-enter the area being sprayed. Typically these are after the agrichemical has dried but for more toxic chemicals this period is extended to allow the concentration to decrease to safe levels. New Zealand currently does not require chemical supply companies to include on their labels information regarding appropriate REI. However, there is significant alignment between New Zealand and Australia in regard to the approach used to the classification and management of agrichemicals. This information is available from Australia in the "Agrochemicals registered for use in Australian viticulture 18/19" booklet published by the Australian Wine Research Institute (AWRI Booklet). I am unaware of a similar resource for orchards so have used this booklet in conjunction with the active ingredient of the agrichemicals.

7.27 The AWRI Booklet provides data for some, but not all, of the active ingredients that are able to be used on orchards, so this list should be considered to be incomplete. The REI for three agrichemicals are listed below:

(a) Captan – 7 days;

(b) Sumisclex – 9-24 days depending on the activity being performed;

(c) Folicur – 4 – 23 days depending on the activity being performed.

7.28 This indicates to me that even once the spray has dried any that has drifted will present risk to residents of the dwelling within the buffer zone and is another reason why the buffer zone should be extended to the maximum recommended. I have drawn this potential buffer zone in **Appendix 15**. This assumes an appropriate shelter belt is established.

Noise

7.29 Noise is a factor that must be considered when considering the appropriate proximity for residential activities to an operational orchard.

7.30 As previously noted in my evidence, wind machines are one of the frost mitigation options. Noise from wind machines is covered by the Central Otago District Plan, Section 4: Rural Resource Area, Rule 4.7.6E (c). I have reproduced this section below:

(c) Wind machines for Frost Control

Any wind machine used for frost control shall be so constructed and operated that any noise emission measured at a distance of 300 metres shall not exceed 65 dBA L10 provided that:

1. the wind machine will be allowed to operate during the frost danger period until the leaves of the plant are dry and the air temperature has reached 1oC.

2. the speed of the wind machine must be governed such that the top speed of the rotor does not exceed the speed of sound.

3. the wind machine is located no closer than 300 metres to any Residential or Rural Settlement Resource Area, or within 100 metres of a dwelling house not located on the property

7.31 This means if PC13 is granted the wind machines located on Suncrest orchard will no longer comply with the rule as they will be located within 300m of a Residential Area which will make them non-complying. This is presented in **Appendix 16**. Noise data from the model of wind machine is presented in **Appendix 17**. This indicates that the model will breach the 65dBA L10 limit at approximately 200m.

7.32 Rule 4.7.6E (d) states:

Where any new activity locates within any part of the Rural Resource Area and that activity includes any noise sensitive activity, the activity or any building

associated with the noise sensitive activity shall be sited, oriented and constructed so as to ensure that habitable spaces within the building shall be adequately isolated from any noise source on another site within the class of sources described in sub-clauses (b) – (c) of this rule. Adequate sound isolation shall be achieved by siting and constructing the building to achieve an indoor design sound level of 45 dBA Lmax within any habitable room where the exterior noise source is within the class of sources described in sub-clauses (b) – (c) of this rule. The indoor design level shall be achieved with windows and doors open unless adequate alternative ventilation means is provided, used, and maintained in operating order.

Reason

The noise standards selected reflects the historic noise levels permitted in the District. Temporary short duration noises (such as those created by frost fighting wind machines, bird scaring devices, harvesting at night etc) have been exempt from these restrictions so as not to unduly restrict seasonal agricultural operations. It is also considered appropriate that where a new activity that may be noise sensitive locates in the rural environment next to an activity that generates noise then the developer of the new activity should take steps to mitigate the effects of that noise. The cost should not be borne by the existing activity unless it does not meet the 70dBA standard.

7.33 If PC13 is approved then this will require that the affected houses need to have adequate insulation to meet the 45 dBA L_{Max} level. The location of the frost fan is such that is will not exceed the 70dBA standard so this would need to built in the minimum design specifications for the dwelling.

7.34 Wind machines are governed by resource consents and their noise managed under the RMA process and even when they comply with the requirements under the District Plan they can cause effects unless the house is not properly acoustically insulated.

7.35 The orchard owner has fought frosts for 25 years on their property using a Hughes 500C helicopter and they have a code of compliance from the CODC for frost operations. According to the orchard owner the helicopter will be deployed to supplement the wind machines during a significant frost event on the

Suncrest orchard, particularly when there is a drift other than from the West. Their noise is much more significant than wind machines according to the report I was able find analysing helicopters this was in the range of 76.5 – 85.5 dBA L_{MAX}. The reference for this report is listed in **Appendix 2**. Frosts can last all night and typically a series of three frosts are experienced. Orchards typically fight frosts from September to the end of November.

7.36 I live on a vineyard and we fight frosts on the neighbouring property with the smallest helicopter available (a Robinson R22 Beta II) and this results in an unbearable level of noise. The Hughes 500C is a much larger helicopter and the noise it generates is commensurately louder. I have deployed these helicopters previously to fight frosts on other properties near residential properties and have received complaints from residents.

7.37 It should also be noted that helicopters are also deployed to dry orchard crops close to maturity after a rain event to stop the fruit from splitting. This occurs mid-summer (depending on the crop being grown) immediately after the rain stops and can be frequent.

7.38 To address the need to get sprays on in the typically windy spring tractor drivers often start very early (5am starts are typical) and orchard staff often start at day break to get the work done in the cooler morning hours during the peak of summer. The orchard owner also informs me that they use noisy equipment regularly, including chainsaws, mowers, mulchers and auto firewood processors. Additional they use heavy machinery regularly with external contractors and this includes 20 ton diggers, high reach tree trimmers, large wood mulchers and dump trucks, all of which generate significant noise, although not always on the boundary shared with the PC13 site.

7.39 Bird scaring is used on both orchards and vineyards when the fruit is approaching ripeness to prevent loss or damage to the fruit from birds eating or pecking the fruit. A range of audible techniques are deployed including gas guns to scare birds away from the fruit. These are designed to be loud, ranging from 90-120 dBA L_{MAX}. According to Section 4.7.6.E (b) these devices cannot exceed 65dB ASEL within the notional boundary (defined as a line 20 metres from part of any living accommodation) or 70dB where the device is sites 500m or more from any Residential Resource Area. There are no restrictions on the number of times such a device can be used in the Operative District Plan. This will mean

that the ability to use bird scaring devices will be severely curtailed on the property and they will not be able to be used within 500m of any notional boundary.

7.40 The sort of noise described above could impact the wellbeing of those living in the proposed residential dwellings. Further, complaints relating to these activities have the potential to compromise the ability to effectively and efficiently grow crops on the orchard.

Effects on the vineyard from the proposed residential activities

7.41 In my experience, residential activities in close proximity to an operational horticultural property can also result in adverse effects on an orchard or vineyard. In particular unintentional damage can be caused to trees and vines by broadleaf sprays used on lawns. These are typically available in supermarkets or applied by contractors. Vines and trees are sensitive to these sprays and it is difficult to identify the causative location or police their use. The effects can be persistent and can travel considerable distance (I am aware of incidents where damage has been caused up to 30 kilometres away).

Conditions of consent

7.42 In my experience restrictions placed on the property such as easements or so called "no complaint" covenants may work during the period of the development whilst the developer is still developing the property to enforce them. However, once the development is completed and the developer no longer maintains a financial interest in the development these fall to the regulatory authority to enforce or the property that the no complaint covenant is registered in favour of and as a result become either largely ineffective or costly to enforce and can ultimately mean the social license to operate the Suncrest orchard is lost. This applies to both spray drift and noise. As such I recommend that, if PC13 is approved, appropriate mitigation of potential adverse effects by requiring offset, shelter belts and build requirements (particularly acoustic baffling and air conditioning the living areas of residential dwellings) are made a requirement of the development rather than relying on no-complaint covenants.

7.43 No complaint covenants do not mitigate the primary effects of the spray drift or noise. As such they are simply a means to restrict purchasers of the properties rights to reasonable enjoyment of their property. Stating that people have a choice not to purchase does not stop them from losing this right in the future.

8 Conclusion

8.1 The desk-based soils analysis undertaken by Mr Hill is, in my opinion, insufficient to determine whether the site contains High Class soils and as such may lead to inappropriate conclusions being drawn on the value of the site as productive land. An on-site soil analysis and an LUC classification should be undertaken to properly evaluate the PC13 site.

8.2 Regardless of the result of this analysis, in my opinion the PC13 site can successfully cultivate grapes. High quality grapes can be grown and ripened on a consistent basis on the PC13 site. The wines that are produced from these grapes will have a distinctive sense of place and have the potential to command international acclaim. In my opinion the intention of the regional policy and rules should be broadly interpreted to protect land which has significant productive potential from being lost to a residential development.

8.3 From a viticultural perspective, the PC13 site is economically viable. It has the potential to grow high quality fully ripe grapes at sufficient yields and will be able to command a price commensurate with the yield/quality tier. When solely considered as a contract grape growing site the majority of yield and price scenarios result in a positive return. I consider that the location of the site in the on State Highway 6 lends itself to capturing additional value using successful business models that progress further along the value chain, particularly in relation to the DTC and tourist business models.

8.4 In my opinion, the Proposal will result in the loss of productive viticultural land that has potential to significantly add to both jobs and revenue for the Central Otago region. The residential subdivision development of the land with the construction of buildings and their associated landscaping will mean the productive land will be lost forever. I consider that the Proposal will result in significant reverse sensitivity issues due to noise, spray drift, tractor and staff activity at early hours, some of which will not be able to sufficiently mitigated to

reduce the adverse effects to acceptable levels. I further consider that reverse sensitivity clauses typically used in such a development are insufficient and will not stop complaints from being made.

James Dicey

20 May 2018

Appendix 1

James Dicey Curriculum Vitae

PROFESSIONAL EXPERIENCE

Grape Vision Limited

Viticultural Development & Management Sep. 04 – present
Owner/Viticulturalist

Development and implementation of viticultural program for 35 vineyards spread over ~250ha. Recruitment, training and management of staff, including ~38 permanent New Zealanders in specialist roles and 40-110 seasonal Ni-Vanuatu via the RSE scheme. Client management. Budgeting and capital expenditure planning. Management of vineyard budgets with a combined value of >$4m. Materials procurement. Management of machinery operations. National and international viticultural and wine business consultancy. Fruit and wine brokerage. Vineyard development in all regions of Central Otago. Consultancy on reverse sensitivity issues in property development and expert witness

Ceres Wines Limited

Wine Brand 2005 – present
Owner

Development of wine brand. Creation of website and associated social media. Securing and managing NZ, UK, US and Australian distribution.

Diageo plc

Premium drinks, London, Feb. 03 – Jul 04
Manager, Business Risk

Deliver IS based risk activities globally. Recent work includes assessing the project risks within SAP implementations as well as the managing the post implementation audit work on the GB, Ireland and Project Sheriff (US) SAP implementations. Development and maintenance of network with senior IS community to identify key IS risks that drives work. Influence the IS agenda to embed appropriate risk culture.

- Work identification and planning – using an extensive network of IS contacts identify key IS risks and develop work programs to assess, mitigate and audit these risks.
- Risk Consulting – risk assessment and mitigation planning for key IS and market risks. Risk consulting on projects and markets to improve the quality of the control environment.
- Risk Auditing – performed financial and IS audits primarily focussed on SAP enabled back offices.

Quickstart Consulting Limited

Project management (self employed), London, Oct. 99 – Oct. 02

Contracts included:

Saudi Aramco (contracted to Deloitte & Touche)
Oil Producer: Dhahran (Saudi Arabia) Aug. 02 – Oct. 02, period 3 months

Contracted by Deloitte & Touche South Africa to project manage a post implementation SAP R/3 review for Saudi Aramco. Complex environment (FI, CO, MM, IS Oil, PS, IM, AM, HR, QA, BW and PM) with high number of users (20,000).

- Project Management - Identification of project requirements, project planning and delivery of report against plan and budget. Staff management (16 staff/10 nationalities), resource allocation, mentoring and assessment.
- Control Frameworks – Identification and documentation of business processes and the development of control frameworks.
- Reporting – Development of reporting standards. Regular status updates to senior management.

Shell Marine Products
Marine Fuel and Lubricants Supplier: London (United Kingdom) Jul. 01 – Feb. 02, period 7 months

Contracted by Shell Head Office to project manage the development and support of core business applications that are used internationally (in over 25 countries, by over 300 users), including changing software suppliers to reduce costs.

- Project Management: development/rollout of a core business application (Rapid Lubricants Analysis 2) internationally, management of pilot phase, development of support model and integration to SAP (focussing on international VAT issues).
- Management of RFP process: managed change of 3rd party software developer.
- Third Party Management: contract drafting, service level negotiation, process/procedure definition and implementation.
- Strategic: Contribution to IT strategy, IT steering committee (business case/project definitions), staff management including project manager mentoring.
- Business Continuity Planning (BCP): Creation and implementation of Shell Marine Products BCP. Shaping the Shell BCP strategy and approach.

WebPerform Group
Internet Performance Services: London (United Kingdom) Nov. 00 – Jul. 01, period 9 months

Assisted Internet start up company (focussed on online performance assessment and improvement) to obtain £7m funding. Reporting directly to the Product Development Director, working as a Programme Manager developing the development and implementation of core business applications (including £1m budgetary control). Promotion to Information Manager with sole responsibility for the development of the business intelligence layer, reporting directly to the WebPerform executive.

- Programme Management: co-ordination and implementation of multiple software and organisational projects. Project management of the following projects:
  - SAP Implementation (FI/CO, Logistics, CRM/SM, and HR). Responsibilities included solution assessment, training, configuration and change management.
  - Bespoke Application Development – specification, analysis and implementation of a core database driven business intelligence layer including an ASP based front end for configuration. Responsibilities included managing testing (including UAT), user training and documentation.
  - Operational Process Development – Creation of pan-organisational operational processes and structures.
- Business Intelligence Layer: scoping, designing and implementing the Business Intelligence Layer

IPC Electric (part of IPC Media)
Publisher: London (United Kingdom) Oct. 99 – Jul. 00, period 10 months

Reporting directly to the Director of Product Development, with sole responsibility for the development, implementation and operation of a B2C e-commerce solution to provide multiple websites with e-commerce functionality, based on a single catalogue.

- Programme Management – Co-ordination of multiple project e-commerce and infrastructure requirements. Management of resource (financial and human) allocation and prioritisation.
- Project Management – Simultaneous project management (up to 4 concurrent projects) from conceptualisation to implementation/project close-down (budgets exceeding £1.5m).
- Other responsibilities – Policy development, third party management (contract/service), E-Commerce strategy development, business process design, front/back end design integration, software requirements specification, testing, operational management of processes (including logistics and fulfillment), international fulfillment and VAT implication analysis, design of support processes, staff selection/training/management, development of project management methodology.

Deloitte & Touche

Professional Services: Feb. 94 – Sep. 00 (New Zealand, Netherlands, United Kingdom)

Senior manager with a professional career starting in financial audit, progressing to IT audit (including significant security training). Transfer to Europe to focus on SAP assurance and implementation (primarily security and business process controls).

- Project Management – Identification of business requirements, project planning and delivery of product against plan and to budget.
- Business Process Mapping – Identification and documentation of business processes and integration to SAP R/3.
- Business Control Identification – Identification and documentation of SAP R/3 functional controls and development of manual controls to mitigate business risk.
- Security Configuration – Identification of security settings. Design, implementation and rollout of security matrix
- Clients included – Philips Luminaires, ASM Lithography, Delphi Automotive, Philips Automotive, Telecom NZ.

PROFESSIONAL QUALIFICATIONS

- Grad. Dip Viticulture & Oenology – Lincoln University, 2005
- Chartered Accountant – Institute of Chartered Accountant of New Zealand, 1997
- Barrister and Solicitor – High Court of New Zealand, 1993
- Bachelor of Law (LLB) – Commercial Law Major (University of Otago, NZ), 1993
- Bachelor of Commerce (BCom) – Accounting Major (University of Otago, NZ), 1992

DIRECTORSHIPS

- Mt Difficulty Wines Limited: 2004 – Present
- New Zealand Winegrowers: 2016 – Present
- New Zealand Winegrowers Research Centre Limited: 2017 – Present
- Seasonal Solutions Co-operative Limited: 2006 – 2016

INDUSTRY COMMITTEES

- 2016 – Present: NZ Winegrowers Finance Committee (Deputy Chair)
- 2016 – Present: NZ Winegrowers Sustainability Committee (Deputy Chair)
- 2006 – Present: Committee Central Otago Winegrowers Association, including 5 years as President (past role)
- 2010-2014: NZ Winegrowers Research Committee
- 2014: Lincoln University Bachelor of Viticulture and Oenology course review committee member
- 2014-2016: Alternate Director for NZ Grape Growers Council

MAJOR AWARDS/TROPHIES

- Ceres Black Rabbit Riesling (2017) – Royal Easter Show Wine Awards Champion Riesling trophy
- Ceres Composition Pinot Noir (2016) – Decanter World Wine Awards New World Pinot Noir Best in Show
- Ceres Composition Pinot Noir (2010) – International Wine and Spirit Competition Bouchard Finlayson Pinot Noir trophy
- Remarkable Wines Pinot Noir (2006) – Decanter World Wine Awards New World Trophy
- Gourmet Traveller Wine 2018 New Zealand Viticulturalist of the Year

TRAINING

- Institute of Directors – Introduction to Governance, Invercargill 2009
- Risk Management Concepts – Diageo, London 2003
- SAP R/3 – Security Review and Implementation, South Africa, 1999
- SAP R/3 – HR module courses, SAP Training Academy, Manchester, 1998
- Computer Assurance – Basic/Advanced IS technical and audit training, Malaysia/Sydney, 1996/1997

Appendix 2

List of documents reviewed in preparing this evidence

Application to the Council

(a) Summary evidence of Reece Blackburn Hill dated 17 April 2019;

(b) Summary evidence of Natalie Hampson dated 23 April 2019;

(c) Evidence of Jeffrey Andrew Brown 23 April 2019;

(d) Section 42A Planning Report Ref 52/3/86;

(e) Assessment of Environmental Effects;

Planning documents

(f) Otago Regional Council Regional Plan: Air for Otago dated 1 January 2009;

(g) Otago Regional Council Regional Policy Statement for Otago 1998 (partially operative as of 14 January 2019);

(h) Central Otago District Council Operative District Plan 2008;

Other relevant material

(i) NZS 8409:2004 Management of Agrichemicals;

(j) Hazardous Substances Classification Codes (https://www.epa.govt.nz/industry-areas/hazardous-substances/rules-for-hazardous-substances/hazardous-substances-classification-codes/)

(k) Land Use Capability Handbook – a New Zealand handbook for the classification of land 3rd Ed;

(l) Agrochemicals registered for use in Australian viticulture 18/19 (https://www.awri.com.au/wp-content/uploads/agrochemical_booklet.pdf)

(m) Helicopter Noise Measurements Data Report: Volume 1 Report No. FAA-RD-77-57, 1 (April 1977), https://rosap.ntl.bts.gov/view/dot/10026, p197

(n) VineFacts for Season 2017-2018 published by New Zealand Winegrowers;

(o) Harvest.com weather station data for Suncrest Orchard and MacMuir Vineyard (Bannockburn);

(p) 2018 Interim Incremental Grape Price Data published by New Zealand Winegrowers;

(q) Wine Tourism Tourist Special Interest February 2014 published by Tourism New Zealand;

(r) Wine Tourism Tourist Activity September 2009 published by the Ministry of Tourism (now Ministry of Business, Innovation and Employment);

(s) New Zealand Wine Tourism Insights published by New Zealand Winegrowers;

(t) Wine Tourism: New Zealand Wine Tourism at a glance published by New Zealand Winegrowers;

(u) International Visitor Survey September 2017 published by Ministry of Business, Innovation and Employment;

(v) Wine industry benchmarks and insights 2017 published by Deloitte;

(w) Queenstown Airport Statistics published by Queenstown Airport October 2018;

(x) New Zealand Tourism Forecasts 2018 – 2024 (May 2018) published by the Ministry of Business, Innovation and Employment;

(y) The New Zealand Soil Classification published by LandCare Research (https://webcast.gigtv.com.au/Mediasite/Play/592c330cdb6045e596a54d5e2b6be5861d?catalog=cf98d83053764395b5e48ae171db49e621)

Appendix 3

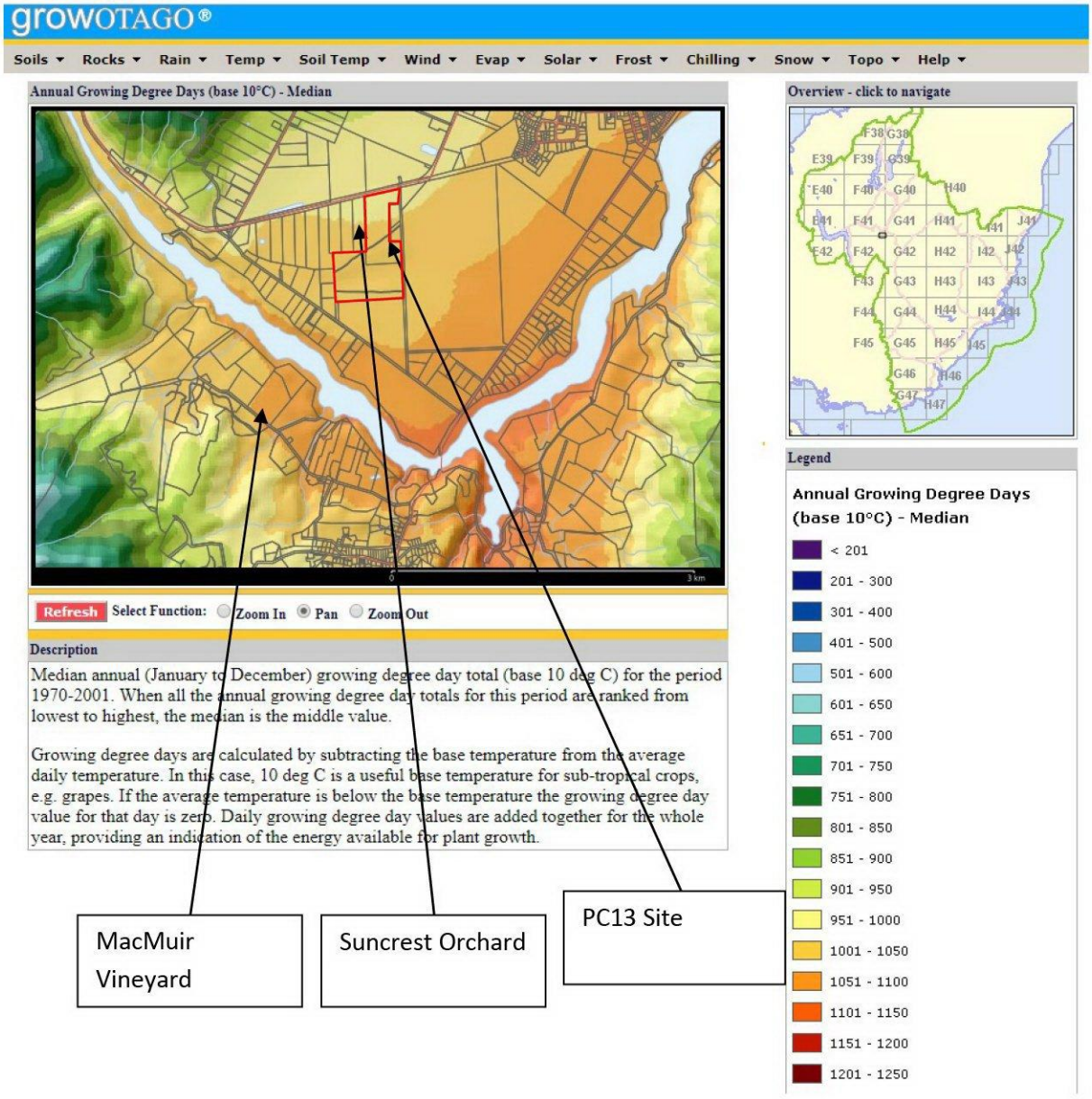
GDD data (source HarvestNZ Weather Stations)

Weather Station	2018 GDD Base 10°C	2017 GDD Base 10°C
Suncrest Orchard (Next door)	1088	757
MacMuir Vineyard (Bannockburn)	1330	950

- The data for 2018 was chosen as it was an unusually hot season in the Central Otago wine growing region
- The data for 2017 was chosen as it was an unusually cool season in the Central Otago wine growing region

Appendix 4

GDD Base 10°C (source GrowOtago)



Appendix 5

Rainfall (source GrowOtago)

growOTAGO®

Soils ▾ Rocks ▾ Rain ▾ Temp ▾ Soil Temp ▾ Wind ▾ Evap ▾ Solar ▾ Frost ▾ Chilling ▾ Snow ▾ Topo ▾ Help ▾

Annual Rainfall - Median

Refresh Select Function: Zoom In Pan Zoom Out

Description

Median annual (January to December) rainfall total (mm) for the period 1970-2001. When all the annual rainfall totals for this period are ranked from lowest to highest, the median is the middle value.

Overview - click to navigate

Legend

Annual Rainfall - Median

- 351 - 400 mm
- 401 - 450 mm
- 451 - 500 mm
- 501 - 550 mm
- 551 - 600 mm
- 601 - 650 mm
- 651 - 700 mm
- 701 - 750 mm
- 751 - 800 mm
- 801 - 900 mm
- 901 - 1000 mm
- 1001 - 1250 mm
- 1251 - 1500 mm
- 1501 - 1750 mm
- 1751 - 2000 mm
- 2001 - 3000 mm
- > 3000 mm

Appendix 6

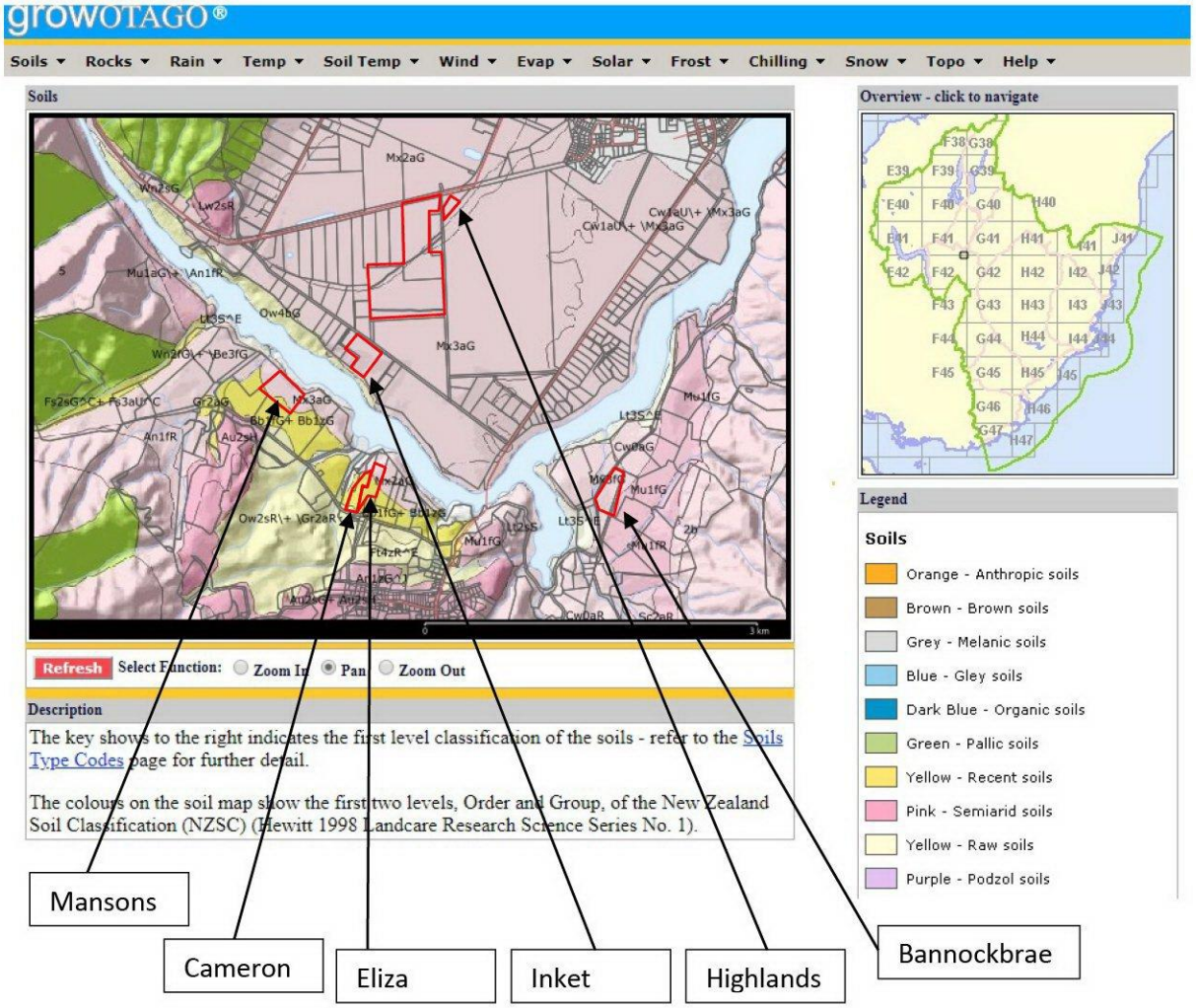
PC13 site productive area map (source Google Tools)

Output : Current Area

| 33.72 hectares | 3629454.58 feet² | 0.13 sq

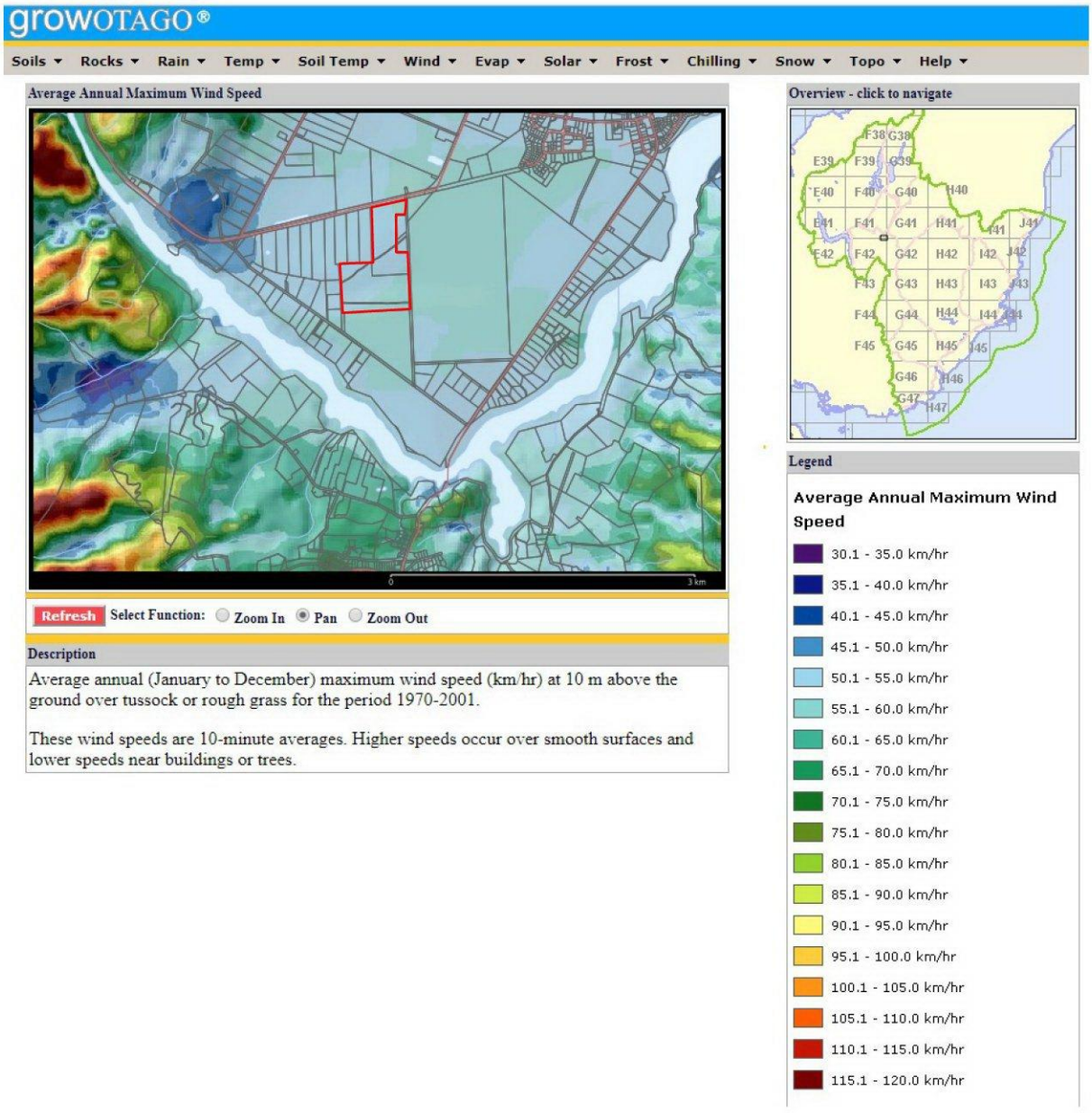
Appendix 7

Soils (source GrowOtago)



Appendix 8

Average Annual Maximum Wind Speed (source GrowOtago)



Appendix 9

Rate of Return on Capital Investment Calculation

To calculate a rate of return the land value should be included into the calculation. In my opinion the site valued as undeveloped bare land (excluding any lifestyle value or value attributed to a residential house platform) would range from $25,000 to $50,000 a hectare.

	Low land value, re-use infrastructure	**Low land value, full development**	**High land value, re-use infrastructure**	**High land value, full redevelopment**
Land Value	25000	25000	50000	50000
Development Cost	64400	91500	64400	91500
Total Investment	**89400**	**116500**	**114400**	**141500**
3% Rate of Return	2682	3495	3432	4245

A 3% return on investment in an agricultural context is about average in my experience – the scenarios presented in my evidence at 6.13 show a return higher than this in 60% of the modelled scenarios.

Using the total investment to redevelop the vineyard it is further possible to calculate a capital gain on investment by calculating the capital gain on the development scenarios presented above. This is calculated by:

(Sale price – Total Investment) = Capital Gain (expressed as a percentage)
Total Investment

Sale Price	185000	185000	185000	185000
Capital Gain %	106% (185,000 – 89,400)/ 89,400	59%	62%	31%
Sale Price	220000	220000	220000	220000
Capital Gain %	146%	89%	92%	55%

Appendix 10

$50 Incremental pricing 2018 Interim (source NZ Winegrowers)

Inc/Range $50		# tonnes	Sales Value	Average Price
1801	1850	2.65	4876	1840
1851	1900			
1901	1950			
1951	2000			
2001	2050			
2051	2100			
2101	2150			
2151	2200			
2201	2250			
2251	2300			
2301	2350			
2351	2400	6.928	16412	2369
2401	2450			
2451	2500			
2501	2550			
2551	2600			
2601	2650			
2651	2700			
2701	2750			
2751	2800	2.65	7415	2798
2801	2850			
2851	2900			
2901	2950			

Inc/Range $50		# tonnes	Sales Value	Average Price
2951	3000	50.661	151983	3000
3001	3050			
3051	3100	28.736	89082	3100
3101	3150			
3151	3200	126.742	404211	3189
3201	3250			
3251	3300	98.968	326594	3300
3301	3350			
3351	3400	78.851	268093	3400
3401	3450	90.97	313847	3450
3451	3500	392.769	1374692	3500
3501	3550			
3551	3600	237.571	852183	3587
3601	3650	1087.75	3969259	3649
3651	3700	4.15	15355	3700
3701	3750	160.337	597790	3728
3751	3800	412.17	1566246	3800
3801	3850	253.31	975200	3850
3851	3900	118.681	462856	3900
3901	3950	11.723	46306	3950
3951	4000	331.525	1326100	4000
4001	4050	42.632	172660	4050
4051	4100	12.019	49278	4100
4101	4150	13.284	55129	4150
4151	4200	176.056	739435	4200

Inc/Range $50		# tonnes	Sales Value	Average Price
4201	4250	58.673	249360	4250
4251	4300			
4301	4350	2.2	9570	4350
4351	4400	58.788	258667	4400
4401	4450			
4451	4500	48.11	216495	4500
4501	4550			
4551	4600			
4601	4650			
4651	4700	18	84600	4700
4701	4750			
4751	4800			
4801	4850			
4851	4900			
4901	4950			
4951	5000			
5001	5050			
5051	5100			
5101	5150			
5151	5200			
5201	5250			
5251	5300			
5301	5350			
5351	5400			
5401	5450			

Inc/Range $50		# tonnes	Sales Value	Average Price
5451	5500			
5501	5550			
5551	5600			
5601	5650			
5651	5700	9.786	55312	5652
5701	5750			
5751	5800			
5801	5850			
5851	5900			
5901	5950			
5951	6000	1.128	6768	6000

Appendix 11

Bulk Wine Scenario Calculation

BULK MODEL					
	Planted Ha	T/ha	Litres/T (finished)		
Yield	28.60	6	630	108,108	Litres
Projected Revenue (Incl)			11.5	1,243,242	
Less GST				162,162	
Projected Revenue Gross (Excl)				1,081,080	
Excise/ALAC Levy (NA on bulk wine)		Litres			
Excise	0	108,108		-	
ALAC Levy	0	108,108		-	
				-	
Cost of Goods Sold					
Vineyard Costs - Growing		16700		477,620	
Vineyard Costs - Lease		0		-	
Vineyard Costs - Deprectaion		775		22,165	
Winery Costs	2.5				

		108,108		270,270	
Barrel Depreciation	1.6	108,108		172,973	
Direct Costs (Bottling, Labelling, Packaging)	0	12,012.00		-	
Total COGS				943,028	
				138,052	13%

Appendix 12

Direct Trade Scenario Calculation

TRADE MODEL					
	Planted Ha	T/ha	Litres/T (finished)		
Yield	28.60	6	630	108,108	Litres
Projected Bottles Produced				144,144	Bottles
Trade Price Per Bottle				28.30	Trade
Projected Revenue (Incl)				4,079,275	
Less GST				532,079	
Projected Revenue Gross				3,547,196	
Excise/ALAC Levy		Litres			
Excise	2.9432	108,108		318,183.47	
ALAC Levy	0.035385	108,108		3,825.40	
				322,009	
Cost of Goods Sold					
Vineyard Costs - Growing		16700		477,620	
Vineyard Costs - Lease		0		-	
Vineyard Costs - Deprecation		775			

				22,165	
Winery Costs	2.5	108,108		270,270	
Barrel Depreciation	1.6	108,108		172,973	
Direct Costs (Bottling, Labelling, Packaging)	20	12,012.00		240,240	
Total COGS				1,183,268	
				2,041,919	58%
Distribution			$/bottle		
A&P/Market Activation			0.40	57,658	
Freight Out			0.32	46,126	
Relabelling/Packing			0.03	4,324	
Admin Overhead			0.60	86,486	
Sales Manager (Salary and expenses)				145,000	
				194,594	
GM After Direct Costs				1,847,325	52%
Per hectare				64,592	

Appendix 13

Distributor Trade Calculation Scenario

DISTRIBUTOR MODEL					
	Planted Ha	T/ha	Litres/T (finished)		
Yield	28.60	6	630	108,108	Litres
Projected Bottles Produced				144,144	Bottles
Distributor Price Per Bottle				21.50	Trade
Projected Revenue (Incl)				3,099,096	
Less GST				404,230	
Projected Revenue Gross				2,694,866	
Excise/ALAC Levy		Litres			
Excise	2.9432	108,108		318,183.47	
ALAC Levy	0.035385	108,108		3,825.40	
				322,009	
Cost of Goods Sold					
Vineyard Costs - Growing		16700		477,620	
Vineyard Costs - Lease		0		-	

Vineyard Costs - Deprectaion		775		22,165	
Winery Costs	2.5	108,108		270,270	
Barrel Depreciation	1.6	108,108		172,973	
Direct Costs (Bottling, Labelling, Packaging)	20	12,012.00		240,240	
Total COGS				1,183,268	
				1,189,589	44%
Distribution			$/bottle		
A&P/Market Activation			0.40	57,658	
Freight Out			0.32	46,126	
Relabelling/Packing			0.03	4,324	
Admin Overhead			0.60	86,486	
				194,594	
GM After Direct Costs				994,995	37%
Per hectare				34,790	

Appendix 14

Direct to Consumer Calculation Scenario

DIRECT TO CONSUMER						
	Planted Ha	T/ha	Litres/T (finished)			
Yield	28.60	6	630	108,108	Litres	
Projected Bottles Produced				144,144	Bottles	
Retail Price Per Bottle				47.50	Retail	
Projected Revenue (Incl)				6,846,840		
Less GST				893,066		
Projected Revenue Gross				5,953,774		
Excise/ALAC Levy		Litres				
Excise	2.9432	108,108		318,183.47		
ALAC Levy	0.035385	108,108		3,825.40		
				322,009		
Cost of Goods Sold						
Vineyard Costs - Growing		16700		477,620		
Vineyard Costs - Lease		0				

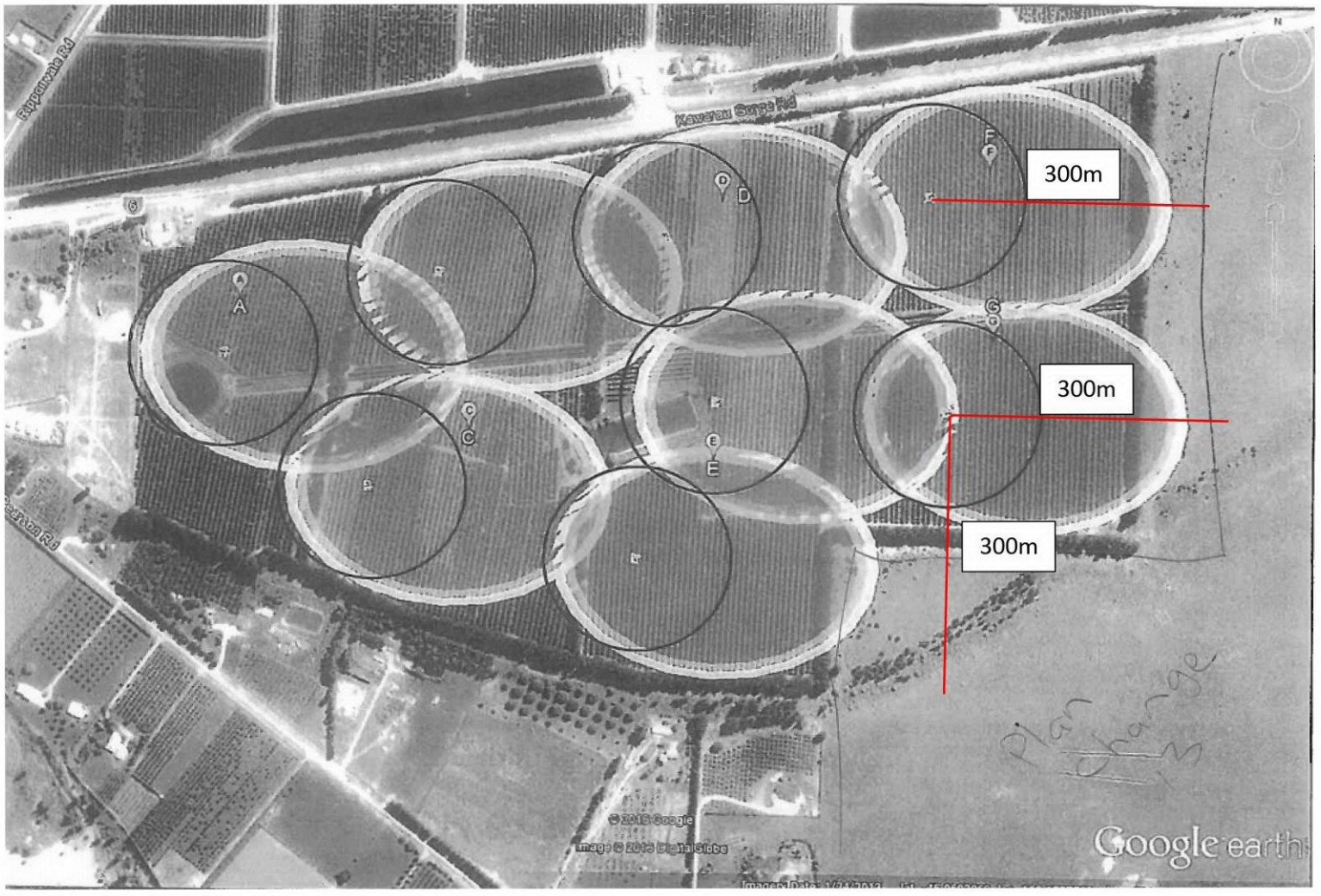
				-		
Vineyard Costs - Depreciation		775		22,165		
Winery Costs	2.5	108,108		270,270		
Barrel Depreciation	1.6	108,108		172,973		
Direct Costs (Bottling, Labelling, Packaging)	20	12,012.00		240,240		
Total COGS				1,183,268	8.21	per bottle
				4,448,497	75%	
Cellar Door Costs						
Staff		45,000	3.50	504,504		
Food				-		
				504,504		
GM After Direct Costs				3,943,993	66%	
Per hectare				137,902		

Appendix 15

100m Buffer

Appendix 16

Wind Machine locations



Appendix 17

Wind Machine Noise Data

HEGLEY ACOUSTIC
CONSULTANTS

3000D FROST FAN
FIELD TESTING OF FROST FAN NOISE LEVELS

INTRODUCTION

This report sets out the results of field measurements undertaken in August 2012 of an Orchard Rite 3000D frost fan. Measurements were undertaken at various speeds 300m downwind from the frost fan as shown on Figure 1.

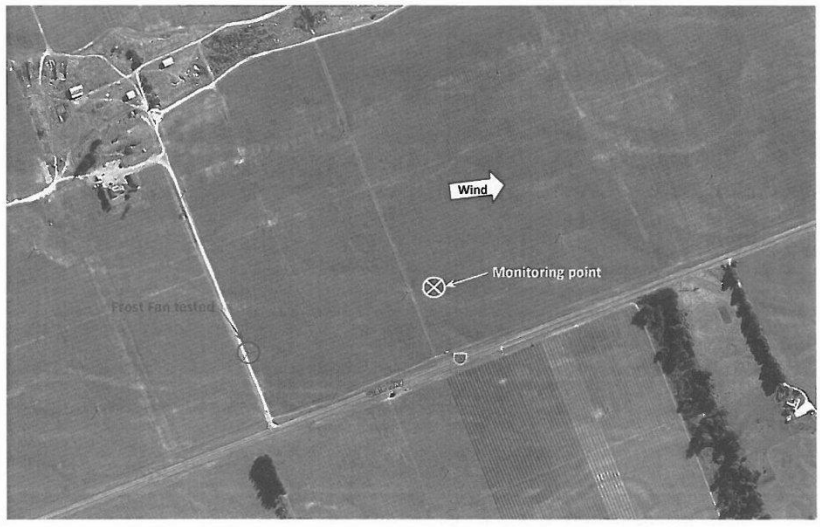


Figure 1. Test Location

TEST CONDITIONS

The weather during the noise monitoring was fine with a clear sky throughout the testing. The wind speed at 10m varied between 3.5 - 8km/hr with one gust of

8.2km/hr, which was not used in the analysis. The wind was blowing from the frost fan toward the monitoring location as shown in Figure 1. The temperature was between 3^0C and 4^0C during the testing.

The meteorological conditions were compatible with those set out for Category 6 in Concawe[1], which gives enhanced meteorological conditions. The measurements the conditions were considered good for monitoring the frost fan noise.

The ground condition between the frost fan tested and the noise measurement locations was nominally flat with sparse grass, pruning debris and bare earth following recent pruning operations and with no leaves present on the vines. These ground conditions represent those most favourable for sound propagation.

The technical information of the frost fan tested is:

- Frost fan model: OrchardRite 3000D
- Engine: John Deere
- Engine model: 6068TF275
- Engine capacity: 6800cc
- Fuel: Diesel
- Number of blades: 2
- Pitch: 8^0
- Blade length 6.22m
- Engine speed: 1850, 2000, 2200 and 2350rpm
- Gear box ratio: Bottom 2.35:1 Top 2.052:1
- Blade rpm: 384rpm at 1,850 engine speed
  415rpm at 2,000 engine speed
  456rpm at 2,200 engine speed
  487rpm at 2,350 engine speed

The noise measurement equipment used was:

- Brüel & Kjær 2250 Hand-held Analyser platform with Sound Level Meter Software BZ 7222, Frequency Analysis Software and BZ 7225 Enhanced Logging Software. Re-calibration is next due in March 2013;

---

[1] The Propagation of Noise from Petroleum and Petrochemical Complexes to Neighbouring Communities, Report No 4/81, May 1981 prepared by C J Manning, Acoustic Technology for Concawe's Special Task Force on Noise Propagation

- Brüel & Kjær ½" type 4189 microphone, serial number 2650951. Re-calibration is next due in March 2013;
- Brüel & Kjær 4230 calibrator serial number 930422. Re-calibration is next due in March 2013;
- Brüel & Kjær type UA0237 90mm diameter windscreen;
- All measurements were undertaken in accordance with the requirements of NZS 6801:1991 *Measurement of Sound* and NZS 6802:1991 - *Assessment of Environmental Sound.* Testing was also compatible with the requirements of NZS 6801:2008 *Acoustics - Measurement of Environmental Sound* and the requirements of NZS 6802:2008 *Acoustics – Environmental Noise*.

TEST RESULTS

In accordance with the requirements of NZS6802, the frost fan attracts a 5dBA penalty to the measured levels due to its special audible characteristics at all tested speeds.

The measured sound pressure levels for each rpm tested (without any adjustment for special audible characteristics) are shown in Table 1.

Fan speed	1850rpm	2000rpm	2200rpm	2350rpm
L_{A10} Level (measured)	59dB	59dB	60dB	60dB
L_{Aeq} Level (measured)	57dB	57dB	58dB	58dB

Table 1. Measured Frost Fan Noise

Based on the above the L_{A10} and L_{Aeq} levels at 100m, 200, 300m 400m and 500m have been calculated as shown in Table 2

Nevil Hegley
December 2012

Orchard Rite 3000D Noise Levels

Engine Speed (rpm)	Distance from Frost Fan										
	100m		200m		300m		400m		500m		600m
2350	72dB L_{Aeq}	74dBA L_{10}	63dBA L_{Aeq}	66dBA L_{10}	58dBA L_{Aeq}	60dBA L_{10}	55dB L_{Aeq}	58dBA L_{10}	52dB L_{Aeq}	55dBA L_{10}	50dB L_{Aeq}
2200	72dB L_{Aeq}	74dBA L_{10}	63dBA L_{Aeq}	66dBA L_{10}	58dBA L_{Aeq}	60dBA L_{10}	55dB L_{Aeq}	58dBA L_{10}	52dB L_{Aeq}	55dBA L_{10}	50dB L_{Aeq}
2000	71dB L_{Aeq}	73dBA L_{10}	62dBA L_{Aeq}	65dBA L_{10}	57dBA L_{Aeq}	59dBA L_{10}	54dB L_{Aeq}	57dBA L_{10}	51dB L_{Aeq}	54dBA L_{10}	49dB L_{Aeq}
1850	71dB L_{Aeq}	73dBA L_{10}	62dBA L_{Aeq}	65dBA L_{10}	57dBA L_{Aeq}	59dBA L_{10}	54dB L_{Aeq}	57dBA L_{10}	51dB L_{Aeq}	54dBA L_{10}	49dB L_{Aeq}

Special Audible Characteristics Adjustment - Add 5dBA to above figures

Table 1. Orchard Rite 3000D Frost Fan Noise Levels