

The background is a vibrant, abstract composition. It features a dense field of circles in various sizes and colors, including purple, green, yellow, and red. A prominent graphic in the center-right is a series of concentric circles in shades of red, pink, and green, resembling a target or a stylized sun. The overall effect is dynamic and celebratory.

# Australian Wine Research Institute

Annual Report 2023

# AWRI

# Australian Wine Research Institute

## Annual Report 2023

The Australian Wine Research Institute Ltd was incorporated on 27 April 1955. It is a company limited by guarantee that does not have a share capital, and is a registered charity with the Australian Charities and Not-for profits Commission.

The Constitution of The Australian Wine Research Institute Ltd (AWRI) sets out in broad terms the aims of the AWRI. The AWRI's activities are guided by its business and research, development and extension plans, and its stated mission, values and behaviours.

### Mission

Supporting the Australian grape and wine industry through world-class research, practical solutions and knowledge transfer.

### Values

Values provide guidance in how the AWRI will deliver on its mission. The AWRI's values are:

- Excellence
- Integrity
- Passion

### Behaviours

The behaviours that support our values are:

#### Excellence

- Outcomes focused, delivering results
- Personal mastery – being the best one can be
- Asking and answering the right questions
- Relevant to industry
- Collaborating to achieve faster, better or cheaper outcomes

#### Integrity

- Accountability to stakeholders
- Dealing honestly, impartially and consistently
- Scientific and professional rigour

#### Passion

- Enthusiasm for our people, our industry and our products
- Spirit of creativity
- Enjoying work and celebrating achievements
- Desire to do better
- Pursuing knowledge and understanding

### Location

The AWRI's laboratories and offices are housed in the Wine Innovation Central Building within an internationally renowned research cluster on the Waite Research Precinct at Urrbrae in the Adelaide foothills. Grape and wine scientists from other organisations are co-located with the AWRI in the Wine Innovation Central Building.

The Waite Research Precinct is also home to other research and teaching organisations including: Australian Centre for Plant Functional Genomics (ACPF), Australian Genome Research Facility (AGRF), Australian Grain Technologies (AGT), Australian Plant Phenomics Facility, CSIRO, South Australian Research and Development Institute (SARDI), the University of Adelaide's School of Agriculture, Food and Wine and the Waite Research Institute.

### Registered office

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#### Postal address

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#### Telephone

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#### Facebook

[www.facebook.com/The.AWRI](https://www.facebook.com/The.AWRI)

#### Instagram

[www.instagram.com/theawri](https://www.instagram.com/theawri)

#### Twitter/X

[www.twitter.com/The\\_AWRI](https://www.twitter.com/The_AWRI)

#### YouTube

[www.youtube.com/c/TheAWRI](https://www.youtube.com/c/TheAWRI)

#### ABN

83 007 558 296

### Acknowledgements

**Edited** by Ella Robinson, Kate Beames and Mark Krstic

**Compilation assistance** from Natalie Burgan, Alfons Cuijvers, Shiralee Dodd and Peter Nguyen

**Design** by KS Design Studio Pty Ltd

**Photography** by Jacqui Way Photography

### Cover artwork

The cover presents part of a larger artwork, 'kaaruyarta – vineyard' by Allan Sumner – Kaurna Ngarrindjeri Yankunytjatjara Artist, April 2023, which hangs in the AWRI boardroom. The artwork expresses a rich cultivated country surrounded by rivers, creeks and significant cultural sites. The vibrant colours speak to an area of rolling hills and flat plans surrounded by native flora and fauna.

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69<sup>th</sup> Annual Report – 30 June 2023

Presented to the Australian grape and wine community

# AWRI





# Chair and Managing Director's report

## Introduction

Challenging climatic, market and economic conditions have been front and centre for the Australian grape and wine industry over the past year, with many producers across Australia feeling the strain. Following the 'unicorn' vintage of 2021 and an average-size vintage in 2022, vintage 2023 saw heavy rainfall and disease across many regions, as well as pressures on profitability caused by oversupply and export challenges. Wine Australia's national vintage survey estimated an Australian wine-grape crush of 1.32 million tonnes, the lowest since 2000, 26% below the 10-year average of 1.78 million tonnes, driven by both climate and market factors. Impacts of the supply/demand imbalance are being felt across our industry, with effects across different regions and business scales. Australian Grape & Wine and Wine Australia are currently working together to develop a new 'One Sector' plan to address key priorities for the wine sector from now to 2030 in response to these recent challenges and changes since the last Wine Australia strategic plan was developed in 2020. As the industry's own R&D organisation, the AWRI's purpose is to support producers in dealing with current and future challenges. We are also contributing positively to the grassroots discussions that are informing development of the new plan.

At the AWRI this year we continued to develop and implement actions under the AWRI strategy, which has the overall goal of transforming our organisation to ensure it has a sustainable future. The strategy, underpinned by an ongoing process of business improvement, is structured under five pillars:

- Tune in to industry
- Push scientific boundaries
- Transfer the knowledge
- Secure our future
- Unlock commercial potential.

While unlocking commercial potential has been an initial priority, with achievements in this area discussed elsewhere in this report, this year we broadened our focus to ensure progress under the other strategic pillars. Industry engagement has been deepened through activities such as consulting with different parts of industry for 'impact' projects, collaborating with diverse grower communities, and developing case studies from sustainable growers and winemakers. We are making improvements to our knowledge transfer activities based on insights from psychology and behavioural science. Our scientists continue to make advances in grape and wine science and to publish the outcomes of their research in high-impact peer-reviewed journals, with the

sequencing of the Shiraz genome just one excellent example from this year. The research team is also challenging itself to push into new areas, such as recent work sequencing vineyard scale insects, always with a focus on solving industry problems or supporting improvements in profitability or sustainability across the Australian wine sector.

## Flow-on effects of small vintage

The AWRI's funding from Wine Australia was affected by the low vintage, with a \$1.47 million (28%) funding reduction to be implemented in the next financial year. This reduction is being managed through short-term decreases in some services, delays or contractions in some research projects, underwriting staff committed to future impact projects from AWRI's strategic reserves, and other cost-cutting measures. In order to maintain capability for the sector during this challenging time, the AWRI is redeploying a number of staff to other parts of the business. While these steps are possible when dealing with a 'one-off' funding reduction, there are significant risks to the AWRI's long-term future under current funding arrangements if smaller vintages become the norm. This possibility has been a key point of discussion for the AWRI Board during the year and ties into the need for transformation identified in our current strategy.

## Wine Australia investment agreement

This year was the first year of a new four-year investment agreement with Wine Australia (2022-2026), signed in June 2022. As reported last year, projects under this new agreement fall into three categories: 'extension & adoption', 'insights' and 'impact'. The first two categories are similar to earlier projects, and progressed well during the year. The impact category is new and requires a different way of working to co-design projects with industry. During the year, AWRI teams working on the co-design process for three impact project areas (no- and low-alcohol (NOLO) wine production, sustainability, and wine production and quality) attended workshops, conducted extensive interviews with industry members, wrote up reports and drafted project summaries and applications in different forms for consideration by Wine Australia and Australian Grape & Wine's Research Advisory Committee. Despite ongoing discussions with Wine Australia, as at 30 June 2023 no new impact projects arising from this co-design activity had been contracted or commenced. It is yet to be seen whether this approach will be successful in its aims of achieving more relevant and impactful outcomes for industry and leveraging increased co-investment from across the sector and supply chain. Certainly the extended nature of the project design process has posed significant challenges for AWRI staff and resources.

## Strategic partnership with University of Adelaide

In July 2022, the AWRI signed a non-exclusive strategic partnership with the University of Adelaide. This agreement provides a framework for the two organisations to work more closely together, with benefits to research and capabilities, as well as the ability to make joint appointments. This agreement also allowed the AWRI's investment agreement with Wine Australia to be novated through the University in December 2022, generating additional research funding to support the wine sector. This change has brought significant benefits and builds on the collaboration and cooperation that have been in place between the two organisation for many years. It is complementary to the joint 'Friendship fund' that was established in 2021 to provide seed funding for new, collaborative AWRI-University of Adelaide initiatives, and it has opened up access to additional research funding to support the Australian wine sector.

## Board changes

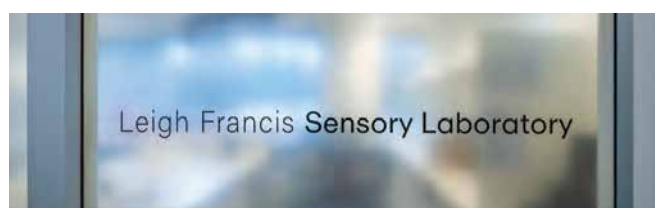
This year saw the completion of Louisa Rose's maximum term of twelve years on the AWRI Board, eight of which were spent as Chair. Louisa's contribution to the AWRI over that period cannot be overstated. She provided calm and considered leadership, informed by her deep knowledge of and dedication to our industry, and will be missed by AWRI Directors and staff alike. After six years on the Board, Prof. Kieran Kirk was re-appointed as a Director and elected to the role of Chair following the end of Louisa's term. Kieran is Dean of the College of Science at the Australian National University in Canberra and Chair of the Board of Clonakilla Wines, his family's winery in the Canberra District wine region. He brings strong scientific credentials and industry understanding to the role of Chair, as well as a keen interest in staff welfare and a collaborative leadership style. During the year the AWRI community was thrilled to see that Kieran was recognised as Member of the Order of Australia (AM) for significant service to science education and research, and to professional organisations.

Other Board changes during the year included the completion of terms by Courtney Ribbons and Toby Bekkers and the commencement of terms by The Hon. Sarah Courtney, Wayne Ellis and Andy Clarke. We would like to thank Courtney and Toby for their contributions and welcome Sarah, Wayne and Andy to the AWRI Board.

The changes to the AWRI's constitution that were passed in 2021/22 and reported in last year's Annual Report have been consolidated this year. We will complete our transition in Board composition by January 2024, with new elected and appointed members to join the Board by that date. The new structure is delivering a good balance between levy payer-elected Directors and those appointed to fill specific skills or diversity gaps, leading to an overall stronger Board and more diverse views around the table.

## Staff changes and achievements

Some significant staff changes and achievements also occurred during the year. The AWRI's longest-serving current staff member, Dr Leigh Francis, retired from his role as Research Manager – Sensory and Flavour, having served the Australian wine industry at the AWRI for more than 35 years. Early in his career at the AWRI, Leigh established the first capability in sensory science, and later consumer science, in South Australia. The sensory team is integral to all AWRI research, with its work ensuring scientific results are always relevant to outcomes in the bottle. To recognise Leigh's immense contribution, the AWRI sensory laboratory was officially named the Leigh Francis Sensory Laboratory.



General Manager (GM) – Corporate Services, Chris Day, resigned after more than 12 years at the AWRI, to pursue a role in a new industry. Chris started his career in the wine industry as a winemaker before changing direction to study accounting. In his time at the AWRI, Chris led finance, human resources, information technology, operations and workplace health and safety, and provided an essential conduit between the AWRI's Executive Management Group and the Board. He also served as Treasurer of the Australian Wine Industry Technical Conference. We were delighted to appoint Peter Nguyen to the GM-Corporate Services role just before the end of the 2022/23 financial year.

In June 2023, former long-standing staff member, Ken Pocock, was awarded a Medal of the Order of Australia (OAM) for his service to oenology. Ken made a major contribution to the Australian wine industry through a 43-year career at the AWRI, during which he advised on technical issues and conducted practical, industry-focused research. Ken was instrumental in developing two important analytical tests that are still used by winemakers today – the measurement of sulfur dioxide in wine and testing wines for heat-unstable proteins that can cause unwanted haze. During his career, Ken worked across many practical aspects of wine quality, contributing to the strong technical basis of winemaking in Australia.

Two senior researchers, Drs Marlize Bekker and Cristian Varela moved on to academic positions – Marlize at the University of Queensland in Brisbane, and Cristian closer to home at the University of Adelaide. We wish them both well and hope to retain close collaborations with them. Research Scientist, Dr Richard Gawel also retired during the year, and we thank him for his significant contributions, particularly in sensory science, statistics and recent research on wine texture.

## New behavioural science capability

For the first time the AWRI has a dedicated capability in behavioural science, co-funded by AWRI and Wine Australia, to help design and evaluate extension and adoption programs to improve rates of practice change. Dr Valeria Bellan, a qualified clinical psychologist with a PhD in cognitive neuroscience and experimental psychology, joined the Industry Development and Support team during the year. She has made excellent contributions so far in upgrading our monitoring and evaluation frameworks and providing support to the development of impact project plans. Benefits from this new capability will be felt across the organisation as Valeria further grows and develops into her role.

## Sustainability and ESG in focus

Sustainable Winegrowing Australia saw substantial membership growth in 2022/23, reaching 1,227 members, up from 933 in 2021/22 and 479 in 2020/21. The proportion of certified members also grew significantly to 52% of the overall membership. This growth in the

number of members becoming certified reflects factors including demand for certification in international markets, increasing consumer desire for sustainability credentials, both in Australia and overseas, and a desire from Australian producers to secure a third-party audit of their practices. Sustainable Winegrowing Australia is governed jointly by Australian Grape & Wine, Wine Australia and AWRI. This structure ensures that the program benefits from the strengths of the three organisations, ensuring a robust technical foundation, detailed market knowledge and strong industry backing. During the year the AWRI increased its own focus on Environmental, Social and Governance (ESG) priorities, with the launch of an ESG committee and inclusion for the first time of ESG reporting in this Annual Report.

## Affinity Labs

As a key part of the AWRI's strategic pillar 'Unlock commercial potential', Affinity Labs has continued to develop new services, new partnerships and new ways of reaching customers across Australia during the year. A strategic partnership with Campden BRI in the UK, signed in March 2023, is supporting the expansion of food and beverage testing in Australia and wine testing in the UK. Across Australia, Affinity Labs is building a network of sample drop-off points that will make it easier for customers in regional areas to get their samples to our laboratories, improving turnaround times and access to services. In Merbein, Victoria, a small sample preparation laboratory is being set up within an existing industry facility to support testing of grapes and grapevine material and also help move other samples to Adelaide. Outside of wine, testing for table grapes has been introduced and partnerships have been established with distillers' organisations, to grow awareness of services available within that sector. More information about developments and progress at Affinity Labs during the year is provided later in this report.

## NOLO advances

This year the NOLO trial-scale research facility, featuring a research-scale spinning cone column, opened at the Hickinbotham Roseworthy Wine Science Laboratory on the Waite Campus. A spinning cone column is a form of low-temperature vacuum steam distillation used for NOLO wine production and flavour capture. The facility was funded by a \$1.98 million grant from the Government of South Australia, through the Department of Primary Industries and Regions, and is operated by the University of Adelaide and AWRI through WIC Winemaking Services. It also includes specialised packaging facilities, which allow successful trial products to be packaged for consumer, trade, market research and export samples. In addition, the AWRI and the University of Adelaide were research partners in a successful CRC-P bid that brings Australian Government funds to support a consortium of industry stakeholders to undertake industry-focused research needed to produce, market and sell NOLO wines that exceed consumer expectations.

## Continued progress in understanding smoke taint

While the past two vintages have been lower risk for bushfires and our industry has been fortunate not to have experienced major smoke events since 2020, research launched in that vintage has progressed and been published in the past year. A key open access peer-reviewed paper on links between concentrations of smoke markers in grapes and eventual smoky characters in wine was published in the *Australian Journal of Grape and Wine Research*, along with a paper that gives further insight into the levels of smoky characters that affect consumer liking. These findings represent major steps forward in global understanding of smoke taint and have practical implications for producers dealing with future smoke events. Additional smoke projects, including a decision tool for producers, remediation of smoke-affected red wine and development of a rapid test for smoke taint, were scoped during the year through the new impact project process, following detailed industry consultations. However, at this stage, no new smoke projects have been funded by Wine Australia.

## Grapevine genomics: world-first publication of Shiraz genome

During the year the research team published the first reference genomes for the key grapevine varieties Shiraz and Sauvignon Blanc, following on from earlier work on Chardonnay and Pinot Noir. This work involved whole-genome sequencing of DNA isolated from Australian clones. It expands the pool of genomes available for wine-grapes and provides a foundational resource for future whole-genome studies. Interestingly, the data for Shiraz also sheds some light on a genetic basis for the 'peppery' character, rotundone. This could potentially provide a genetic marker for the production of 'peppery' characters in future grape breeding strategies.

## Final reports from previous Investment Agreement

Eighteen final reports from the 2017 Investment Agreement with Wine Australia were submitted on 30 September 2022. The three remaining final reports, on market access, wine texture and wine compositional trends, were submitted in early December 2022. This finalised all outstanding work under the 2017-2022 AWRI-Wine Australia Investment Agreement. It is anticipated that Wine Australia will publish these reports on their website.

## International partnerships

Participation in international partnerships and forums is important for maintaining the AWRI's relevance and reputation within the global fields of wine science and wine regulation, as well as to ensure that the AWRI, and through it the Australian wine industry, remains in touch with the latest developments. Our scientists have shared their knowledge at international conferences, both online and in-person, and we have started to welcome back international students and visitors to the AWRI for short and medium length stays. Such exchanges of knowledge and development of networks are an essential aspect of modern science. AWRI's membership of formal alliances such as Bordeaux-Adelaide-Geisenheim (BAG) and OENOVITI plays an important role in underpinning these activities.

## Expansion of educational courses

This year the AWRI launched an Advanced Wine Technology Course, expanding its stable of educational courses that started more than 30 years ago with the Advanced Wine Assessment Course. The new wine technology course involved participants travelling across several wine regions, exploring topics including NOLO wine and spirits production, winery technology to improve energy efficiency, automation and sensor technology, clarification and filtration, packaging, and innovations from other food and beverage industries.

## Artwork and cultural awareness

Mr Allan Sumner (Director Aboriginal Contemporary Arts Studios), a local Kurna Ngarrindjeri Yankunytjatjara artist, was engaged by the AWRI to develop a bespoke piece of artwork for the AWRI boardroom. The initial brief for this piece of art was to link land and climate to food production, and to draw parallels between the wine industry's interpretation of terroir and how this translates into a local Kurna interpretation of people, place, climate and food. Allan has titled the work 'Kaaruyarta – vineyard' and a section of the work features on the cover of this Annual Report. Allan describes the work as expressing a rich cultivated country surrounded by rivers, creeks and significant cultural sites. The vibrant colours speak to an area of rolling hills and flat plans surrounded by native flora and fauna. In parallel with the installation of the new artwork, Allan delivered two First Nations cultural awareness workshops with AWRI staff in August and September 2022.



## Staff development

Staff development continues to be an important focus at the AWRI to ensure we maintain and build our capabilities to support the Australian grape and wine industry. The first cohort of our two-year internal Leadership Development Program completed this year, and a third group joined the program. In addition, individual staff were able to access a wide range of external development opportunities including support for training in management, project management, communication and grant writing. Group sessions for all staff were also held on strategies for personal resilience.

## Technical trends from the AWRI helpdesk

As in previous years, the queries received by the AWRI helpdesk were strongly influenced by weather conditions during the growing season and vintage. Australia's third La Niña event in as many years developed in early September 2022 and continued through to the end of the year. A negative Indian Ocean Dipole was present throughout winter and spring, resulting in above-average rainfall over parts of southern Australia. The Southern Annular Mode remained positive throughout spring and summer, also bringing cooler and wetter conditions. The combined cooler and wetter climate drivers, along with high soil moisture content across central and eastern Australia, delayed flowering until December in many regions, which in turn delayed berry development and resulted in a late harvest. The cooler and wetter conditions, including flooding in some regions, also increased pest and disease pressures during spring and early summer, in particular downy mildew and *Botrytis*. Cases of bacterial inflorescence rot, caused by the bacterium *Pseudomonas syringae* pv. *syringae*, were also reported and the helpdesk responded by distributing information on testing and mitigation steps.

## Vineyard resting

Growers in several regions requested information and assistance regarding 'mothballing' or 'resting' vineyards, as a way of addressing the impacts of over-supply pressures. AWRI viticulturists attended several regional meetings on this topic, and collated key information for producers. The application of ethephon and calcium nitrate to reduce yield were investigated and permits were obtained from regulators to allow their use.

## Prescribed fuel reduction burns

Due to the generally wetter year and additional vegetative growth, several states again brought forward prescribed fuel-reduction burns to early-to-mid-March, causing concern for growers whose fruit remained on the vine due to the delayed season. The AWRI continues to assist state and regional associations to communicate with forest and fire management authorities about the dangers of controlled burns, especially in a year like this one with a delayed harvest window.

## Looking towards vintage 2024

Winter 2023 was much drier than normal for Queensland and the east coast, and wetter throughout South Australia and Victoria. Water reserves are still high following three years of wetter conditions. It seems likely that the upcoming season will see dryer and hotter conditions than have been experienced over the past three seasons. Concerns about water availability and bushfires are likely to take over from more recent issues of flooding and disease pressures. While the smaller 2023 vintage may have lessened some of the oversupply issues our industry is grappling with, profitability concerns remain very real. AWRI is committed to continuing to support producers in dealing with the challenges they are facing.

## Expressing our thanks

The AWRI community is grateful to the grape and wine producers, large and small, across Australia who participated in research and development projects during the year and who contributed their thoughts and ideas to consultations carried out as part of co-design activities. Our close connections with industry are essential to enhancing the value and impact of our projects and services.

Every year the AWRI works closely with a wide range of clients and investment partners and operates more than 100 active research collaborations. We gratefully acknowledge these partners and their contributions to the success and sustainability of the Australian grape and wine industry. Wine Australia is thanked for both its financial support and close cooperation during the year as we navigated some new ways of working together. The strength of our relationship is essential to the ongoing innovation our industry needs to thrive. Australian Grape & Wine, under the new leadership of Lee McLean, is thanked for its continuing strategic guidance to the AWRI and to our industry more broadly.

Members of the AWRI Board are gratefully acknowledged for their hard work and dedication during the year. And finally, it is the professional, committed, capable and resilient AWRI staff who make our organisation what it is. Thank you for everything you do for the industry we serve.



**Kieran Kirk**  
Chair



**Mark Krstic**  
Managing Director







## Board members

### **Ms L.E. Rose**

(to 31 December 2022)  
BAppSc (Oen), BSc, GAICD  
Chair – Elected under Clauses 25.2(c) and 27 of the Constitution  
(Levy payer-elected Director)

### **Prof. K.D. Kirk AM**

BSc (Hons), PhD, DPhil  
Chair (from 1 January 2023)  
Appointed under Clauses 25.2(b) and 26 of the Constitution  
(Appointed Director)

### **Mr T.J. Bekkers**

(to 31 December 2022)  
BAppSc (Ag) (Hons), GradCert (Mgt), GAICD  
Elected under Clauses 25.2(c) and 27 of the Constitution  
(Levy payer-elected Director)

### **Mr A.J. Clarke**

(from 1 January 2023)  
BAGSc (Vitic), GAICD  
Elected under Clauses 25.2(c) and 27 of the Constitution  
(Levy payer-elected Director)

### **The Hon. S.J. Courtney**

(from 1 November 2022)  
BChemEng (Hons), BCom (Fin), MSc (Wine Technol and Vitic), GAICD  
Appointed under Clauses 25.2(b) and 26 of the Constitution  
(Appointed Director)

### **Mr W.I. Ellis**

(from 1 January 2023)  
BAppMgmt  
Appointed under Clauses 25.2(c) and 27 of the Constitution  
(Levy payer-elected Director)

### **Ms P. Giannini**

BEC, GradDipAcc, CA  
Appointed under Clauses 25.2(b) and 26 of the Constitution  
(Appointed Director)

### **Dr M.P. Krstic**

BAGSc (Hons), PhD, MBA, GAICD  
*Ex officio* under Clauses 25.2(a) and 25.5 of the Constitution as  
Managing Director of the AWRI

### **Mr B.M. McClen**

BAGSci (Hons), MBA  
Elected under Clauses 25.2(c) and 27 of the Constitution  
(Levy payer-elected Director)

### **Ms C.L. Ribbons**

(to 31 December 2022)  
BCom, CPA, GAICD  
Appointed under Clause 27.4 of the Constitution  
(Levy payer-elected Director)

### **Ms E.A. Riley**

BAppSc (Wine Sci), GAICD  
Appointed under Clauses 25.2(b) and 26 of the Constitution  
(Appointed Director)

### **Mr T.N. Sneyd MW**

BAppSc (Wine Sci), DNO, MBA, GAICD  
Elected under Clauses 25.2(c) and 27 of the Constitution  
(Levy payer-elected Director)

### **Ms C.N. Wright**

BCom, BAGSc (Oen)  
Elected under Clauses 25.2(c) and 27 of the Constitution  
(Levy payer-elected Director)





## Board notes

### Chair

Ms L.E. Rose (to 31 December 2022)  
Prof. K.D. Kirk (from 1 January 2023)

### Audit committee

Ms P. Giannini (Chair), Ms C.L. Ribbons (to 31 December 2022),  
Mr B.M. McClen, Ms S.J. Courtney (from 28 February 2023)

### Personnel committee

Ms L.E. Rose (Chair) (to 31 December 2022), Prof. K.D. Kirk  
(Chair) (from 1 January 2023), Mr T.N. Sneyd, Mr W.I. Ellis  
(from 28 February 2023)

### Nominations committee

Dr J.S. Harvey (Independent Chair), Ms N. Palun (Independent  
member), Mr T.J. Bekkers (to 31 December 2022), Ms E.A. Riley,  
Ms C.N. Wright (from 28 February 2023)

## Meetings

### Ordinary General Meeting

The 68<sup>th</sup> Ordinary (Annual) General Meeting was held on  
29 November 2022.

### Board

The Board of the AWRI met on the following dates: 19 and  
20 September 2022; 29 November 2022; 28 February 2023;  
20 March 2023; 30 and 31 May 2023.

## Investment

The Board of the AWRI acknowledges the continuing financial support of Wine Australia; the Government of South Australia; Landscape South Australia; the Australian Government Department of Agriculture, Fisheries and Forestry; the Australian Government Department of Industry, Science and Resources; and Bioplatforms Australia, along with a large number of confidential commercial clients. The AWRI is committed to investing the funding it receives from Wine Australia in accordance with the performance principles for Research and Development Corporations set out by the Australian Government.

## Appreciation

The AWRI benefits greatly from collaborations with individuals and organisations from the following countries: Australia, Canada, France, Germany, Indonesia, Italy, South Africa, UK and USA. The assistance and cooperation provided by these partners across the globe are gratefully acknowledged.

*Pictured left to right: Wayne Ellis, Sarah Courtney, Brett McClen, Corrina Wright, Mark Krstic, Trish Giannini, Kieran Kirk (Chair), Andy Clarke (to August 2023), Liz Riley, Nigel Sneyd*



### **Shiraz genome sequenced**

AWRI researchers referenced the genome of the Shiraz grapevine, the most-planted wine-grape variety in Australia.



### **NOLO trial-scale facility**

A trial-scale facility for the production of no- and low-alcohol wines was launched in conjunction with the University of Adelaide.



### **New knowledge about vineyard scale insects**

Metagenomic techniques were applied for the first time to understand the scale insects, parasitoids and other insects present in Australian vineyards.



### **Behavioural science supporting extension and practice change**

A behavioural scientist was appointed to support the design and evaluation of extension activities, ensuring the greatest possible industry impact.

## Highlights of the year

### Customers, consumers and markets

#### **Consumer response to high-proline wine blends**

Wines from a structured blending experiment combining a low-flavour Cabernet Sauvignon, a high-proline Cabernet Sauvignon (both from a warm inland region) and a high-colour, high-tannin Lagrein were assessed by 126 regular red wine consumers. Blends of the low-flavour wine with the high-proline wine were more liked than the blends with the high colour, tannin and flavour blend component. This highlights the potential for wine producers, particularly in warm inland regions, to target proline-rich grapes and wine for enhancing perceived sweetness, viscosity and flavour intensity, while masking unwanted bitterness and excessive astringency.

#### **New agrochemical options**

Project staff worked with chemical suppliers to identify active constituents that are not currently registered for use in viticulture, but which might be useful if registration could be obtained. This resulted in three chemical companies identifying an active constituent that might be applicable in viticulture to control a pest or disease problem.

#### **Delegation to India**

The AWRI participated in an Australian trade delegation to India to attend the first India-Australia Wine Regulatory Forum. The delegation focused on building technical links and understanding between the two countries' wine industries and developing a common regulatory framework. The group also participated in the first Australia-India inter-governmental joint dialogue on wine, where two working groups were launched. The first will review the barriers to wine trade between the two nations and the second will work towards developing an Indian Wine Research Institute (similar to the AWRI) and promoting other opportunities for knowledge sharing.

#### **Expansion of smoke analysis ring test**

A pilot study testing the variation between international laboratories measuring smoke markers in grape material was completed, demonstrating the effectiveness of using freeze-dried homogenate as a stand-in for fresh grape material. The success of this pilot study has led to the funding of a major proficiency testing round for 20 international laboratories, across four continents, comparing their analysis of smoke markers in grape material.

### Extension, adoption and education

#### **New behavioural science capability**

The AWRI now has a behavioural scientist on staff to support the design, evaluation and monitoring of projects, drawing on insights from education, psychology and cognitive neuroscience. This new capability is enhancing the quality of extension, adoption and practice change programs, ensuring they achieve the greatest possible impact in industry.

#### **Foliar spraying practice change priority**

A third practice change priority, on the use of foliar sprays to increase flavour potential in grapes, commenced this year. Four producers participated in vintage trials, resulting in wines from different regions that will be used in workshops in the second half of 2023.

#### **Raising awareness about little-known bacterial disorder**

Following a number of cases of necrosis and rot of inflorescences investigated by the helpdesk during the year, information was collated on bacterial inflorescence rot, a disorder caused by the bacterium *Pseudomonas syringae* pv. *syringae*. This is a low-risk pathogen in dry and warm seasons, but its development and spread are favoured by wet conditions such as those experienced in the 2023 season. AWRI viticulturists worked with researchers from multiple organisations to collate and present the most up-to-date information in a new fact sheet.

#### **Face-to-face events**

Five roadshow seminars and four workshops were delivered in 2022/23. Three workshops provided practical training on spray application and the fourth covered content from two current practice change themes: aeration of ferments and foliar spraying to boost tropical flavours.

#### **AWRI and Affinity Labs websites**

More than 228,750 visitors accessed the AWRI website during the year (5,000 more than previous year) resulting in 631,560 page-views. New and updated technical content on the AWRI website covered topics including managing waterlogged vineyards, grapevine viruses, yeast propagation, vineyard disease assessment, *Brettanomyces* and NOLO winemaking. A total of 16,720 users visited the new Affinity Labs website and it received 190,210 page-views.



## Webinars

Twenty webinars were presented to a total of 1,667 attendees in 2022/23, with the most popular webinar topic being regenerative viticulture. There were also 13,400 views of this year's webinar recordings on the AWRI YouTube channel.

## Podcasts

The second series of 'AWRI decanted' was completed during the year, with six episodes released between July and September 2022. Episodes covered topics in viticultural research and highlighted practitioners who were putting the research into practice in their businesses. All episodes of the first two series of 'AWRI decanted' are freely available via podcast apps.

## Helpdesk support

During 2022/23, the AWRI helpdesk responded to 1,976 wine and viticulture enquiries and conducted 153 investigations. Viticulture query numbers were higher than average for the second year in a row, in part due to the cool and wet conditions driving queries on the control of pests and diseases. Queries on winemaking practices were also elevated, covering a wide range of topics including skin contact for white wines, yeast culture propagation, aeration of ferments and production of NOLO wines.

## Library services

In 2022/23 the library responded to 1,321 reference and information requests, and provided a total of 2,592 non-open access articles, an increase of 54% from the previous year. Ongoing efforts to provide direct links to articles available from publishers' websites resulted in users accessing 2,739 open access articles from various online tools on the AWRI website. In total, 5,331 articles were provided or accessed in 2022/23.

## Inaugural Advanced Wine Technology Course

An Advanced Wine Technology Course was launched during the year, adding to the AWRI's suite of advanced-level courses, tailored to industry practitioners. The new course covered topics including NOLO wine and spirits production, winery technology to improve energy efficiency, automation and sensor technology, clarification and filtration, packaging, and innovations from other food and beverage industries.

## Horticultural apps

Building on expertise developed in the AWRI's agrochemicals project, four apps were delivered to assist horticultural producers to comply with chemical residue requirements in the production of avocados, melons, berries and mangos.

## ShowRunner

Forty shows totalling approximately 17,000 entries used the ShowRunner platform in 2022/23. The system now operates as a web-based platform with options for shows to self-run the software and for the ShowRunner team to deliver support remotely.

## Performance, products and processes

### New ways to influence 'flint' or 'struck match' aromas

Phenylmethanethiol (PMT) and 2-furylmethanethiol (2-FMT) have been shown in previous work to contribute to 'flint' or 'struck match' aromas in wine. Small-scale trials in Chardonnay confirmed that diammonium phosphate (DAP) additions and choice of commercial wine yeast strains affected the formation of PMT. This work is now being expanded to large-scale trials including an industry trial. The effects of post-fermentation treatments on PMT and 2-FMT concentrations were also assessed in Chardonnay. American and French oak chips significantly increased the concentration of 2-FMT, and high levels of SO<sub>2</sub> addition at bottling produced the greatest PMT concentration.

### Survey of oak-related aroma compounds in premium wines

A survey of barrel-fermented and/or barrel-aged commercial premium Australian Shiraz, Cabernet Sauvignon, Pinot Noir and Chardonnay wines assessed the prevalence of compounds that have been proposed as barrel ageing markers: oak lactones, volatile phenols, furanones, aldehydes, thiazoles, PMT and 2-FMT. Several new methods were developed or improved to help produce accurate quantitative data. This work is providing insights on under-studied positive characteristics in wine (e.g. 'caramel', 'red berry' and barrel fermentation-related flavours) and will help direct future projects, based on industry priorities.

### Smoke taint publications

Two key papers from earlier smoke taint research were published this year. The first links results from grape analysis to the likelihood of perceptible smoke characters in wine and confirmed that the current suite of 13 smoke exposure markers in grapes can predict smoky flavour in wine. We now have a good understanding of the concentrations of smoke markers in grapes that produced smoky wine for Chardonnay, Pinot Noir and Shiraz. This will support producers to understand their risk and make informed decisions about processing. The second paper reported on three consumer studies which clearly showed that smoke characters in wine negatively affected consumer liking, across different wine styles.

### 'Raisin'/'jammy' flavour in Shiraz and other red grapes

Chemical markers associated with overripe Shiraz were found to be increased in Shiraz grapes with later harvest dates, but not necessarily related to temperature or extent of shrivel. With the focus previously being on shrivel, which is particularly observed in Shiraz grapes, this study was expanded in vintage 2023 to understand the presence of overripe-related compounds in non-Shiraz red grapes, including Cabernet Sauvignon, Merlot and Durif.



## Genetic analysis of vineyard scale infestations

Metagenomic techniques were applied to understand the ecosystem of scale insects, parasitoids and other insect species present in vineyards. Scrapings of scale-infested vines were collected from eight vineyards across South Australia and subjected to whole-genome sequencing. The species *Parthenolecanium corni* was found to be a significant member of the scale infestations, confirming empirical observations of scale with two or more cycles of offspring per year within Australian vineyards. This will have significant implications for the development of control strategies for this group of pests.

## Learning more about proline in Australian wines

A survey of amino acids in hundreds of Australian wines uncovered a wide range of proline concentrations, which appear to be strongly influenced by cultivar and region. Proline has previously been shown to contribute sweetness, fruit flavour and viscosity in red wines. In addition, sensory threshold tests showed that proline is approximately as potent as sucrose in red and white wines of different styles and model wine.

## Understanding cold stability in red wines

Studies of cold stability during fermentation and ageing showed that red wines invariably lose a significant quantity of unstable potassium bitartrate early in fermentation, and naturally cold stabilise. Losses of monomeric anthocyanin with ageing may contribute to minor changes in cold stability over time.

## Plasma technology to improve membranes

Plasma technology offers the capability to alter the characteristics of filtration membranes, including their charge, roughness and hydrophobicity/hydrophilicity, enabling precise control of their surface properties. This opens up avenues for the development of innovative and improved membranes for use in beverage processing.

## Applying CRISPR to improve yeast traits

CRISPR technology represents a significant advancement in genome editing that, under specific conditions, can be used under a non-genetically modified organism framework. CRISPR was successfully applied in commercial wine yeast strains to introduce novel biochemical pathways allowing production of high amounts of desirable flavour and aroma compounds during fermentation.

## New factor in diacetyl production during co-inoculated MLF

Elevated concentrations of the 'buttery' compound diacetyl were produced when *Oenococcus oeni* was co-inoculated with high sulfur dioxide-producing strains of *Saccharomyces cerevisiae*, suggesting that SO<sub>2</sub> may be a potential mediating factor in diacetyl production. The wines with high diacetyl concentrations were found to exhibit 'buttery' characters by a sensory panel.

## Genetic links between SO<sub>2</sub> tolerance and copper sensitivity in wine yeast

Previous work identified a negative association between SO<sub>2</sub> tolerance and copper tolerance in *Saccharomyces cerevisiae* wine yeasts, meaning that many SO<sub>2</sub>-tolerant wine yeasts tended to be sensitive to elevated copper concentrations. A gene that mediates SO<sub>2</sub> tolerance in wine yeast was identified as contributing to sensitivity of yeast to elevated copper concentrations. It also suggests that selection for moderate SO<sub>2</sub> tolerance might be a preferred strategy for breeding yeast strains with broad stress-tolerance traits.

## NOLO co-design with industry

Under a new Wine Australia framework for impact projects, more than 30 interviews were conducted with wine industry professionals from all segments of industry, to better understand the gaps in research and the 'pain points' of producers, suppliers, and retailers of NOLO wine products. Some of the key issues identified were a lack of aroma, flavour and mouthfeel in NOLO wines, caused by the process of removing alcohol from wine. Six initiatives were proposed to Wine Australia based on insights from this consultation, of which three are progressing towards contracting after review.

## Wine production and quality co-design with industry

AWRI staff conducted 200 interviews with representatives from across the wine sector to discuss priorities and pain points related to wine production and quality. Based on this extensive consultation, 14 diverse proposals were submitted to Wine Australia, five of which are progressing towards contracting.

## Environment, sustainability and natural capital

### Sustainable Winegrowing Australia membership and certification growth

Membership of Sustainable Winegrowing Australia grew to 1,227, a 32% increase from 2021/22, representing 45% of Australia's vineyard area and 44% of the national crush. There was also a significant increase in the proportion of members achieving certified status, growing from 24% of members in 2021/22 to 52% in 2022/23.

### National picture of Australia's sustainable wine production

The sustainability team provided nationally aggregated data and worked with Wine Australia to deliver the second annual Sustainable Winegrowing Australia Impact Report.

### Updated life cycle analysis for Australian wine

Aggregated and de-identified data from Sustainable Winegrowing Australia was used to update the life cycle analysis for Australian wine originally conducted by the AWRI in 2016. This analysis, published in the *Wine & Viticulture Journal*, also informed the wine industry's Emissions Reduction Roadmap being developed by Wine Australia.

### Sustainability co-design with industry

Incredibly valuable insights were gained through consultation with the sector, which resulted in the identification of priorities and pain points in sustainable grape and wine production. From 40 initial proposals aligned with the themes of sustainable inputs, circularity and evidence-based metrics, a total of 15 initiatives were developed and shared with Wine Australia. Six of these were chosen by Wine Australia for review. Of these, only one proposal, on capturing and generating value from fermentation CO<sub>2</sub>, was selected for further development.

### Reference genome for Shiraz

A reference genome for Shiraz, the most-planted grapevine variety in Australia, has been produced. This has provided a detailed view of







the genetics that underpin this cultivar, including the discovery of a specific combination of genetic variants linked to the production of the 'peppery' compound rotundone.

### Genome sequencing of Australian grapevine germplasm

Genome sequencing has been performed for more than 800 grapevine samples across 23 varieties. This represents the majority of clones from the main suppliers of grapevine germplasm in Australia. Clustering of samples using unique DNA fingerprints has produced detailed maps of clonal-specific DNA variation that can be used to identify specific clones within each cultivar.

### Further optimisation of autonomous vehicles for vineyard weed control

Testing of autonomous vehicles for weed control in vineyards continued. The tractor fitted with an autonomy kit last year was successfully tested on longer runs (~50 km). Additional sensors on implements and a camera system that detects people and obstacles boosted overall performance and safety. An autonomous weeding robot and autonomous lawnmowers were also trialled, but both were found unsuitable for use in Australian vineyards.

## Foundational data and support services

### Affinity Labs

Affinity Labs had a strong year despite the wine industry facing difficult market conditions. Total sample numbers for 2022/23 (23,094) were 15% lower than the three-year (2020 to 2022) average (27,166), reflecting the overall reduction in the Australian crush, which was approximately 26% lower than the long-term average. Customer numbers grew by 136, a 20% greater increase than last year.

### Strategic partnership between Affinity Labs and Campden BRI

Affinity Labs has initiated a strategic partnership with the UK's largest food and beverage testing group, Campden BRI. This partnership will see both organisations exchange capabilities and knowledge to increase their offerings in their respective markets.

### Spirits benchmarking

Affinity Labs delivered a benchmarking study comparing the sensory and chemical make-up of a range of commercial whiskeys from around the world. This program grouped the various products by both these sensory and analytical characteristics, giving an understanding

of how they differed and which compounds were responsible for these differences. Going forward this will be an important tool for local producers, as it will enable them to benchmark their own products as well as modify production practices to target specific market segments and product outcomes.

### NOLO trial-scale facility

A small-scale spinning cone column used to remove alcohol from wine was installed and commissioned, sourced under a grant from the South Australian Government to the University of Adelaide. The equipment forms the centrepiece of a new NOLO trial-scale facility, launched during the year, which offers a low-risk environment for Australian wine producers to trial new NOLO products. The service is being managed by WIC Winemaking Services.

### Board appointment processes implemented

The AWRI Board welcomed the first Directors appointed under the new appointment and election processes approved by Members the previous year. In particular, the first Director elected by Grape Research Levy payers joined the Board.

### ISO certification for Metabolomics SA

Metabolomics SA gained ISO 9001 certification for conformance to the ISO9001:2015 standard for specialist services for the analysis of small organic molecules.

### New lipidomics capability

Metabolomics SA now offers a lipid profiling service, thanks to the commissioning of a new high resolution mass spectrometer. The analysis targets more than 650 lipids from 21 different classes and is applicable to multiple matrices. Lipids are an important component of plants, food and animals, and cover a variety of functions such as energy storage, nutrient transport, regulation and signalling, making their analysis an important part of understanding any biological system.

### Citizen science identifying new yeast strains

At the end of its second year, AWRI's citizen science project 'Yeast catchers' has worked with more than 2,000 student scientists from more than 50 schools in six states and territories. Over 6,000 individual yeast isolates were assessed to determine their species using DNA-based microbial profiling techniques. At least 89 species of yeast were identified across 32 genera.





## Staff

The number of AWRI staff employed in a full-time, part-time and casual capacity as at 30 June 2023 was 142 (103.5 full-time equivalents). When the number of AWRI-based students (both from Australia and overseas) and visiting researchers is added, the total increases to 152. Of these, approximately 55.2% were funded by Wine Australia in 2022/23.

### Office of the Managing Director

**Mark Krstic**, BAgSc (Hons), PhD *UniTas*, MBA *MelbBusSchool*, GAICD, Managing Director

**Shiralee Dodd**, BA, LLB (Hons), GradDip (Legal Prac) *UniAdel*, Company Secretary

**Mardi Longbottom**, BAgSc (Vitic Sci), MVit, PhD *UniAdel*, Manager – Sustainability and Viticulture

**Ella Robinson**, BA, BSc (Hons) *UniAdel*, Communication Manager

**Tony Robinson**, BSc (Hons) (Hort and Vitic) *UniWA* and *UniAdel*, PhD *Murdoch*, General Manager – Business Development

**Natalie Burgan**, Cert IV (Bus Admin) *National Group Training*, Dip (Proj Mgt) *SG Learning and Development*, Executive Officer/AWITC Conference Manager

**Kate Hardy**, BA, LLB (Hons), GradDip (Legal Prac) *UniAdel*, GAICD, Legal Advisor

**Liz Pitcher**, BAgSc (Hons) *UniAdel*, BAppSc (Vitic) CSU, Cert IV (Training and Assessment) *Harrison Training Group*, Sustainability and Viticulture Specialist

**Kyla Schmidt**, Dip (Wine Mktg) *UniAdel*, Marketing Lead

**Alexander Hargrave**, BA, BlntStud, GradCert Appl Proj Mgt *UniAdel*, MA *Flinders*, Sustainability Project Officer (from 19 August 2022 to 30 June 2023)

**Cerys Colquhoun**, BCA (Vis Effects and Ent Design) *Flinders*, Design and Communication Coordinator/AWITC Communication Officer

### Corporate Services

**Peter Nguyen**, LLB (Hons), GradDip (Legal Prac), BComm *Flinders*, CA, GAICD, General Manager – Corporate Services (from 26 June 2023)

**Chris Day**, BAgSc (Hons) (Oen), MBA *UniAdel*, GradCert (Chart Acc Found) *Deakin*, CA, GAICD, General Manager – Corporate Services (to 12 May 2023)

**Angus Forgan**, BSc (Hons) *Flinders*, Operations and Research Laboratory Manager

**Adam Holland**, Cert IV (IT) *NTUni*, IT Manager

**Alfons Cuijvers**, MLaw *UniAntwerp*, Human Resources Manager

**Catherine Borneman**, BBus (Acc) *RMIT*, CA, Accountant

**Fang Tang**, Undergrad (Foreign Econ) *RenminUniChina*, GradDip (Fin Mgt), MCom *UniNewEng*, Finance Officer





**Pauline Jorgensen**, Cert III (Bus Admin) TAFE SA, Finance Officer

**Kylee Watson**, Cert III (Fin Services) TAFE SA, Finance Officer

**Alex Hennig**, Cert IV IT (Networking) TAFE SA, Microsoft Office Associate, IT Support Officer

**Josephine Giorgio-Ion**, BUrbRegPlan (Hons) UniSA, Receptionist

**Jennifer O'Mahony**, Receptionist

## Research

**Markus Herderich**, staatlich geprüfter Lebensmittelchemiker (CertFoodChem), PhD UniWürzburg, GAICD, Director of Research

**Keren Bindon**, BSc (Hons) (Biol) UniNatal, MSc (Plant Biotechnol) Stellenbosch, PhD (Vitic) UniAdel, Research Manager

**Anthony Borneman**, BSc (Hons), PhD UniMelb, Research Manager – Molecular Biology

**Leigh Francis**, BSc (Hons) Monash, PhD UniAdel, Research Manager – Sensory and Flavour (to 30 June 2023), Honorary Fellow

**Simon Schmidt**, BSc (Hons), PhD Flinders, Research Manager – Biosciences

**Yoji Hayasaka**, DipEng (Ind Chem) Tokyo IT, MPharm Victorian College of Pharmacy Monash, PhD Yamanashi, Honorary Fellow

**Paul Henschke**, BSc (Hons), PhD UniAdel, Emeritus Fellow

**Cristian Varela**, BSc (Biochem), MSc (Biochem), PhD (Chem Eng and Bioprocesses) CatholicUniChile, Principal Research Scientist

**Marlize Bekker**, BSc (Ind Chem), BSc (Hons), MSc (Chem), PhD (Chem) Stellenbosch, Principal Research Scientist

**Agnieszka Mierczynska-Vasilev**, MSc (Chem), PhD UniLodz, Principal Research Scientist

**Jenny Bellon**, BSc (Biochem and Genet), PhD UniAdel, Research Scientist

**Toni Garcia Cordente**, BSc (Chem), BSc (Biochem), PhD (Biochem and Mol Biol) UniBarcelona, Research Scientist

**Peter Costello**, BSc (Hons), MSc UniNSW, PhD UniAdel, Research Scientist

**Richard Gawel**, BSc, GradDip (Ed) UniAdel, GradDip (Oen) Roseworthy, PhD Deakin, Cert IV (Workplace Training and Assessment) TAFE SA, Research Scientist (to 2 December 2022)

**Josh Hixson**, BTech, BSc (Hons) Flinders, PhD UniAdel, Senior Research Scientist

**Darek Kutyna**, MSc AgUniPoland, PhD Victoria, Research Scientist

**Cristobal Onetto**, MSc, PhD UniAdel, Research Scientist

**Mango Parker**, BSc (Chem) Flinders, PhD UniSA, Research Scientist

**Wes Pearson**, BSc (Wine Biochem) UniBritishColumbia, GradCert (Appl Sensory Sci and Consumer Testing) UC Davis, PhD CSU, Research Scientist

**Tracey Siebert**, ScTechCert (Chem) SAIT, BSc (Org Chem and Pharmacol) UniAdel, PhD UniSA, Research Scientist

**Chris Ward**, BSc (Hons) (Genet and Evol), PhD UniAdel, Research Scientist

**Sheridan Barter**, BTech (Foren and Analyt Chem), BSc (Hons) Flinders, Senior Scientist

**Damian Espinase Nandorfy**, BSc (Hons) (Oen and Vitic) *BrockUni*, GradCert (Appl Sensory and Consumer Sci) *UC Davis*, Senior Scientist

**Stella Kassara**, BSc (Hons) *UniAdel*, Senior Scientist

**Mark Solomon**, BSc (Hons) (Med Chem) *Flinders*, Senior Scientist

**Flynn Watson**, BSc (Hons) (Double Chem) *UniAdel*, Senior Scientist

**Eleanor Bilogrevic**, BSc (Nutr and Food Sci) *UniSA*, GradCert (Appl Sensory and Consumer Sci) *UC Davis*, Scientist

**WenWen Jiang**, BBioeng *DalianPolytech*, MOenVitic *UniAdel*, Scientist

**Charlotte Jordans**, BSc (Biochem), MSc (Agron) *UniCopenhagen*, Scientist (to 22 June 2023)

**Allie Kulcsar**, BSc (Foren and Analyt Sci) (Hons) *Flinders*, Scientist

**Desireé Likos**, BSc (Biochem and Microbiol) *UniAdel*, GradCert (Appl Sensory and Consumer Sci) *UC Davis*, Scientist

**Lisa Pisaniello**, BSc (Foren and Analyt Sci) *Flinders*, Scientist

**Tim Reilly**, BSc (Hons) (Nanotech) *Flinders*, Scientist

**Steven Van Den Heuvel**, BSc (Hons) (Molec Biol) *Flinders*, Scientist

**Alex Schulkin**, BSc *Bar-Ilan*, GradDip (Oen) *UniAdel*, Scientist

**Kate Cuijvers**, BSc (Hons) (Genet) *UniAdel*, Cert II (Medical Service First Response) *StJohn*, Technical Officer

**Laura Hale**, BSc (Genet), BSc (Hons) (Evol and Paleobiol) *UniAdel*, Technical Officer

**Deanna Langone**, BSc (Hons) (Foren and Analyt Sci), PhD *Flinders*, Technical Officer

**Jane McCarthy**, Cert (Anim Hand), Cert (Vet Nurs) *TAFE SA*, AdvCert (Med Lab Sci) *UniSA*, Technical Officer

**Joe Rossi**, BSc (Hons), PhD *UniAdel*, Technical Officer

**Song Qi**, BSc (Molec and Drug Design) *UniAdel*, Technical Officer

**Jelena Jovanovic**, Purchasing Officer

**June Robinson**, Laboratory Assistant

## Metabolomics South Australia

**Natoiya Lloyd**, BSc (Hons) *Flinders*, PhD *UniAdel*, Manager Metabolomics SA

**Vilma Hysenaj**, BSc, M (Pharm Chem), PhD (Food Chem) *UniGenova*, Research Scientist

**Luca Nicolotti**, M (Chem and Pharmaceut Technol), PhD *UniTurin*, Research Scientist

**Maryam Taraji**, BSc (Appl Chem) *UniGuilan*, MSc (Analyt Chem) *Al-Zahra*, PhD *UniTas*, Research Scientist

**Don Teng**, PostGradDip (Math and Stat), MSc (Bioinform) *UniMelb*, Lead Data Engineer

**Danielle Carter**, DipHRM *TAFE SA*, Cert IV (Pers Inj Mnt), Lean Six Sigma Yellow Belt (Advanced) *UniAdel*, Sustainability Officer/Quality Assurance Officer – Metabolomics SA

**Georgia Davidson**, BSc (Hons) (Foren and Analyt Chem) *Flinders*, Technical Officer

## Sensory panel

Nina Blake, Junko Blaney, Amy Cantor, Allison Cox, Amanda Dalton-Winks, Sara Davis, Penelope Elliot, David Evans, Penelope Fox, Philippa Hall, Sonya Henderson, Mary-Jane Hendry, Carrie Hill, Mary Likos, Beverley Kil, Susan Lincoln, Patrick Liu, Rosemary McCarron, Kerin Montgomerie, Dimple Melwani, Liam O'Mahony, Virginia Phillips, Pierre Rafini, Sue Robinson, Jane Schapel, Makiko Sheehy, Heather Smith, Corey Spencer, Jacqueline Stone, Volker Trede, Susan Zabrowarny, Matthew Zdenkowski

## Industry Development and Support

**Con Simos**, BAppSc (Oen) *UniAdel*, MBA *UniSA*, Group Manager – Industry Development and Support

**Peter Dry**, BAgSc, MAgSc, PhD *UniAdel*, Emeritus Fellow

**Linda Bevin**, BBus (Info Mgt), GradDip (Lib and Info Stud) *QUT*, Information and Knowledge Manager

**Valeria Bellan**, BPsychSc, MClinPsych *UniPavia*, PhD (Cog Neurosc and Exp Psych) *UniMilanoBicocca*, Behavioural Scientist/Psychologist (from 24 October 2022)

**Adrian Coulter**, BSc *Flinders*, GradDip (Oen) *UniAdel*, Senior Oenologist

**Geoff Cowey**, BSc (Hons) *UniAdel*, BAppSc (Wine Sci) *CSU*, Dip WSET (Certified Educator), Cert IV (Training and Assessment) *Malyon*, Senior Oenologist

**Matt Holdstock**, BSc *Flinders*, GradDip (Oen) *UniAdel*, Senior Oenologist

**Robyn Dixon**, BSc, GradDip (Vitic) *UniAdel*, MAppSc *Lincoln*, Senior Viticulturist

**Marcel Essling**, BBus *Victoria*, BAgSc *UniAdel*, Senior Viticulturist

**Chris Penfold**, MAppSci (Ag) *UniAdel*, Senior Viticulturist

**Christa Schwarz**, BViticOen *UniAdel*, Technical Officer – Viticulture

**Ben Cordingley**, BSc (Hons) (Biotechnol) *UniNSW*, BWineSc *CSU*, Oenologist

**John Gledhill**, BAppSc (Wine Sci), BAppSc (Vitic) *CSU*, Winemaker

**Francesca Blefari**, BBus *UniEdithCowan*, Project Manager

**Anne Lord**, GradDip (Info Stud) *UniSA*, Librarian

**Rosanne Dunne**, BA (Info Stud) (Public and Corp Info Mgt) *UniSA*, AALIA, Library Coordinator

**Russell Desmond**, BViticOen *UniAdel*, Assistant Winemaker

**Will McSorley**, DipEventMgt *TAFE SA*, Project/AWITC Conference Coordinator

**Alishia Izzo**, Cert III (Business) *Trison Business College*, Cert III (Events) *Australian Tourism College*, Project Coordinator (from 5 August 2022 to 17 November 2022)

**Jessica Scudds**, BCA (Fashion Design and Tech) *Flinders*, Project Coordinator

**Maria Calabrese**, Event Coordinator (from 20 March 2023)

**Clara Moutakis**, BPA *UniSA*, Cert III (Retail) *TAFE SA*, Event Coordinator (from 30 November 2022 to 2 March 2023)





## Affinity Labs

**Eric Wilkes**, BSc (Hons) (Chem), PhD *UniNewcastle*, General Manager – Affinity Labs

**Neil Scrimgeour**, BSc (Hons) (App Chem) *Wolverhampton*, Business Development Manager

**Leanne Hoxey**, BSc *UniAdel*, Manager Operational Support

**Amy Rinaldo**, BBiotech (Hons) *Flinders*, PhD *UniAdel*, Manager Applied Biosciences (to 24 March 2023)

**Nuredin Habili**, BAgSc (Hons), PhD *UniAdel*, Emeritus Fellow

**Simon Nordestgaard**, BEc, BE (Hons) (Chem), PhD *UniAdel*, Principal Engineer

**Bryan Newell**, BAppSc (Chem and Physics) *UniSA*, Team Leader – Analytical Laboratory

**Pamela Solomon**, BTech (Foren and Analyt Chem), BInnovationEnterprise (Sci and Tech) *Flinders*, Trace Laboratory Manager

**Susanne Copeland**, MBiochemEng *MannheimUniAppSci*, Quality Assurance Coordinator

**Kieran Hirlam**, BE (Hons) (Chem), BFin *UniAdel*, Project Team Manager

**Marco Schoeman**, BSc (Biotechnol) *UniAdel*, Customer Service Manager

**Wen-Hsiang (Denny) Hsieh**, BChemEng *TatungUni*, MChemMatEng *NationalCentralUniTaiwan*, MViticOen *UniAdel*, Project Engineer

**Caroline Bartel**, BSc (Hons) (Biotech) *UniAdel*, Scientist

**Laura Bey**, BSc (Foren and Analyt Chem), GradCert (Bus Admin) *Flinders*, Scientist (to 8 July 2022)

**Thomas Hensel**, BTech (Foren and Analyt Chem), BSc (Hons), MSc (Chem) *Flinders*, Scientist

**Simone Madaras**, BSc (Hons) (Foren and Analyt Chem), PhD *Flinders*, Project Scientist

**Heather Tosen**, BSc *UniAdel*, Scientist

**Jesse Hall**, BSc (Foren and Analyt Sci) *Flinders*, Technical Officer

**Ida Batiancila**, Laboratory Technician

**Zung Do**, BFoodSc, MFoodSc *HanoiUniSciTechnol*, PhD *UniAdel*, Laboratory Technician

**Joshua Lennon**, BSc (Chem), BMATHCompSc *UniAdel*, Laboratory Technician

**Jacinta McAskil**, Cert III (Lab Operations) *Sunraysia TAFE*, Laboratory Technician

**Rhiannon Mensforth**, BNutrFoodSc *UniSA*, Laboratory Technician (from 19 September 2022 to 10 May 2023)

**Emily Milsom**, BSc (Hons) (Chem) *UniAdel*, Laboratory Technician

**Emma Muehlberg**, BTech (Foren and Analyt Chem), BSc (Hons), PhD *Flinders*, Laboratory Technician

**Jessica Schrapel**, BSc (Hons) (Foren and Analyt Sci) *Flinders*, Laboratory Technician

**Dean Smiley**, Laboratory Technician

**Matthew Wheal**, BSc (Hons) (Biol), PhD *UniAdel*, Laboratory Technician

**Qi Wu**, BPlantProtection *SouthChinaAgric*, MPlantHealthBiosecurity *UniAdel*, Laboratory Technician

**Xiaojun (Sara) Zhan**, BViticOen *UniAdel*, Laboratory Technician

**Rachel West**, BTech (Foren and Analyt Chem), BSc (Hons) (Foren and Analyt Chem), PhD *Flinders*, Operational Support Technician

**Yihe (Eva) Sui**, MViticOen, PhD *UniAdel*, Project Technician

**Robyn Gleeson**, Customer Service Officer

**Jillian Lee**, Customer Service Officer

**Gina Sellars**, Laboratory Assistant

**Susan Lincoln**, Courier (from 25 January 2023)

**Paul Witt**, Courier (to 21 December 2022)

## Students

**Jana Hildebrandt**, *UniSA*, PhD student

**Bryce Polley**, *QUT*, MPhil student





## Staff activities

**Anthony Borneman** is an Affiliate Associate Professor at the University of Adelaide.

**Natalie Burgan** is Executive Officer for the Wine Innovation Cluster Leadership and Research Committees (to 31 March 2023) and a member of the planning committee for Crush – the grape and wine science symposium.

**Cerys Colquhoun** is Executive Officer for the Wine Innovation Cluster Leadership and Research Committees (from 1 April 2023) and a member of the planning committee for Crush – the grape and wine science symposium.

**Ben Cordingley** is a committee member for the Interwinery Analysis Group.

**Adrian Coulter** is an Affiliate Lecturer at the University of Adelaide.

**Chris Day** is a Chartered Accountant and a Director, Treasurer and Public Officer of the Australian Wine Industry Technical Conference (to 12 May 2023).

**Robyn Dixon** is a member of Barossa Vine Improvement Committee, Riverland Grape and Wine Technology Group, Biodiversity McLaren Vale Group and Riverina Vineyard Technical Group.

**Peter Dry** is an Adjunct Associate Professor at the University of Adelaide and Associate Editor of the *Wine & Viticulture Journal*.

**Rosanne Dunne** is an executive member of the Australian Library and Information Association's Government and Special Libraries Sector Committee.

**Angus Forgan** is a member of the South Australian Institutional Biosafety Committee Network Forum and a member of the SA Biobank Technical Reference Group.

**Leigh Francis** is an Associate Editor of the *Australian Journal of Grape and Wine Research*; a member of the Editorial Board of the *Journal of the Science of Food and Agriculture* (to 24 October 2022); an Affiliate Associate Professor at the University of Adelaide; and an Adjunct Associate Professor at the University of South Australia.

**Paul Henschke** is an Associate Editor of the *Australian Journal of Grape and Wine Research*; an Affiliate Professor at the University of Adelaide; and Fellow of the Australian Society of Viticulture and Oenology.

**Markus Herderich** is an Affiliate Professor at the University of Adelaide; Director of the Australian Wine Industry Technical Conference; and member of the Metabolomics Australia Executive Management Group. He is also Vice President of the Organisation Internationale de la Vigne et du Vin (OIV) and the OIV's Sub-commission on Method of Analysis and an expert in Commission-II (Oenology); a member of the Wine Industry Technical Advisory Committee; a member of the Wine Innovation Cluster Research Group; and an Associated Editor of *OenoOne*.

**Kieran Hirlam** is a member of Australian Grape & Wine's Packaging Committee; a member of the Independent Brewers Association Sustainability Group; and a member of the Australian Distillers Association Safety and Sustainability Committee.

**Denny Hsieh** is social media coordinator for the Winery Engineering Association.

**Mark Krstic** is an Adjunct Professor at Macquarie University; Chair of the Australian Wine Industry Technical Conference; Director of the National Wine Foundation; member of Hort Innovation's Table Grape Strategic Investment Advisory Panel; member of the Waite Strategic Leadership Group; member of the OENOVITI and BAG International Executive Committee; member of Australian Grape & Wine's Sustainability Advisory Committee; Associate Editor of *Wine & Viticulture Journal*; Honorary Senior Fellow at the University of Melbourne; and a graduate of the Australian Wine Industry Future Leaders Program.

**Natoiya Lloyd** is a member of the Metabolomics Australia Executive Management Group and the Metabolomics Australia Analytical group.

**Mardi Longbottom** is a member of Australian Grape & Wine's Sustainability Advisory Committee; member of the Environmental Technical Committee of Freshcare Ltd; and Fellow of the Governor's Leadership Foundation Program.

**Agnieszka Mierczynska-Vasilev** is an Affiliate Associate Professor at Flinders University and a member of the Australian Near Infrared Spectroscopy Group.

**Peter Nguyen** is a Chartered Accountant and a Director, Treasurer and Public Officer of the Australian Wine Industry Technical Conference (from 28 June 2023).



**Simon Nordestgaard** is Conference Manager for the Winery Engineering Association.

**Cristobal Onetto** is an Affiliate Senior Lecturer at the University of Adelaide.

**Wes Pearson** is a committee member of the McLaren Vale Districts Group and a graduate of the Australian Wine Industry Future Leaders Program and the Len Evans Tutorial.

**Amy Rinaldo** is a member of the Wine Industry Suppliers Association Viticulture Working Group and a member of the Australian Grapevine Virology Technical Committee (to 24 March 2023).

**Tony Robinson** is a Director of the Australian Wine Industry Technical Conference (from December 2022); an *ex officio* Councillor of the Royal Agricultural and Horticultural Society of South Australia and a member of the Wine Show Sectional Committee; an alumnus of the Australian-American Fulbright Program; a graduate of the Australian Wine Industry Future Leaders Program; and an MBA Candidate and Aspiring Leaders Scholarship recipient at the University of Adelaide Business School.

**Kyla Schmidt** is a National Science Week SA coordinating committee member.

**Neil Scrimgeour** is a member of the Independent Brewers Association Quality & Technical Group; a member of the Australian Distillers Association Technical Standards Project Group; and a

member of the Innovation and New Product Development, Food Microbiology and Sensory and Consumer Science Special Interest Groups with the Australian Institute of Food Science and Technology.

**Con Simos** is a member of the WA Wine Industry Association R&D Committee and a graduate of the Australian Wine Industry Future Leaders Program.

**Cristian Varela** is a member of the Editorial Board of the journals *Applied and Environmental Microbiology*, *International Journal of Food Microbiology*, *Food Microbiology* and *FEMS Yeast Research*. He is also an Affiliate Senior Lecturer at the University of Adelaide and member of the Australian Society of Viticulture and Oenology.

**Rachel West** is Samples Coordinator for the Interwinery Analysis Group.

**Matthew Wheal** is the Secretary and South Australian representative of the Australasian Plant and Soil Analysis Council.

**Eric Wilkes** is a member of the expert panel of the Sub-commission on Method of Analysis in OIV's Commission-II (Oenology); a member of the Wine Industry Technical Advisory Committee; co-chair of the FIVS (International Federation of Wines and Spirits) Scientific and Technical Committee; Chair of the FIVS working group on smoke impacts; and a member of the Wine Industry Suppliers Association committee.





# Project Reports

## Customers, consumers and markets

*The Australian wine industry depends on producing wines that consumers value, trust and are able to access in both domestic and international markets. Projects under this theme aim to provide technical guidance on agrochemical use to meet export market requirements; to preserve the integrity and quality of Australian wine; and to contribute technical expertise to national and international forums on wine regulation.*

### Staff

Marcel Essling, Thomas Hensel, Prof. Markus Herderich, Anne Lord, Christa Schwarz, Dr Eric Wilkes.

### Collaborators

Agrochemical manufacturers, suppliers and consultants; Agrochemicals Reference Group; Australian Grape & Wine (Tony Battaglione, Damien Griffante, Anna Hooper, Lee McLean); Australian Pesticides and Veterinary Medicines Authority (APVMA) (James Deller); Bronco Wines (Paul Hukuba); CropLife Australia (Jana Phan, Gregory Sekulic); Department of Agriculture, Fisheries and Forestry (Veronica Lee, Timothy Ruben); E. & J. Gallo Winery, USA (Steve Tallman); ETS Laboratories, USA (Gordon Burns); FIVS (Bennett Caplan, Dr Greg Hodson, Ignacio Sanchez); Food Standards Australia New Zealand (FSANZ) (Dr Mark FitzRoy); GrapeLink (Graeme Forsythe); Grapeweb (Okhi Oktanio, Mark Riddell); Homologa (Olivier Flandre); Organisation Internationale de la Vigne et du Vin (OIV), France (Pau Roca, Dr Jean-Claude Ruf); South Australian Research and Development Institute (SARDI) (Dr Ismail Ismail, Dr Mark Sosnowski); Pernod Ricard Winemakers (Philip Deverell); Treasury Wine Estates (Dr Marcos Bonada); Wine Australia (Steve Guy, Rachel Triggs); Wine Institute, USA (Katherine Bedard).

## Supporting market access, safety and regulation

### Background

Maintaining market access and opening markets for Australian wine are facilitated by managing and reducing current and potential barriers to trade. The Australian wine industry needs to anticipate, facilitate and influence regulation of wine composition, production, labelling and marketing, which could affect market access for Australian wine. This project provides industry stakeholders with timely and accurate technical information to inform policy positions. In addition, it supports representation at national and international industry forums in order to raise awareness of matters of concern to the Australian wine industry.

### Technical aspects of supporting market access

The project team actively participated in international meetings held by organisations including the International Wine Technical Summit, FIVS, World Wine Trade Group and the OIV. Support was also provided to Australian Grape & Wine's Wine Industry Technical Advisory Committee, with information delivered on changes to the international regulatory environment and opportunities to improve market access.

During the year, recommendations were made to the OIV on updating permitted maximum limits for gum arabic and arsenic in wine, and the use of polydimethylsiloxane as an anti-foaming agent. The project team also participated in electronic working groups seeking to extend the use of D- and D/L tartaric acid for calcium stabilisation of wine and discussing the application of *de minimis* principles in the reporting of analytical results.

Dr Eric Wilkes participated in a trade delegation with Wine Australia and Australian Grape & Wine to India and presented at the inaugural India-Australia Wine Regulatory Forum. This delegation focused on building technical links and understanding between the wine industries of the two countries, and developing a common regulatory framework to ease the export and distribution of wine to emerging markets in India. This will help leverage the reduced tariffs introduced through the recent trade agreement between India and Australia. The delegation also participated in the first India-Australia inter-governmental joint dialogue on wine, with representatives from the Australian Government. A major outcome of this was the initiation of two working groups. The first will review the barriers to wine trade between the two nations and the second will work towards developing an Indian Wine Research Institute (similar to the AWRI) and promoting knowledge transfer.

World Wine Trade Group (WWTG) meetings during the year focused on ways to bring greater consistency to definitions of sustainability among participating nations and to try and influence those used in the international marketplace for wine. A new working group, chaired by Australia and New Zealand, was initiated, which will develop recommendations on definitions of sustainability and how to best



align sustainability requirements between trading nations. The WWTG also continued to monitor international technical barriers to trade, providing a robust database of emerging issues and a forum to develop common responses.

The FIVS Scientific and Technical Committee (STC) seeks to provide information on emerging technical issues in the export and import of wines and robust scientific data to support efforts to change technical trade barriers. A major effort this year focused on supporting compliance with the new e-label regulations within the EU, which come into force in December 2023. These new rules will require the inclusion of a QR code on bottles that links to online ingredient and nutritional information on all wines sold in the European market, as well as the inclusion of a value for the dietary energy content of the wine on the physical label. The committee is preparing papers based on international survey data on the fat, protein and salt content of wine, essentially highlighting the position that for typical wine the values for these components are always below the limit required for reporting and, as such, a zero value can be used without the need for testing. If accepted, this has the potential to deliver significant cost savings for producers.

In a related vein, the FIVS STC has developed a paper, currently under review, outlining the relative uniformity of dietary energy content in wines of the same style and proposing the use of generic values for this labelling. This paper, which was heavily influenced by work conducted by the AWRI for submission to FSANZ for consideration in upcoming Australian regulation, will be used to inform submissions to various international regulatory bodies and as the basis for a paper submitted to the next OIV congress.

The work of the FIVS working group on smoke impacts, chaired by Dr Eric Wilkes, continued to focus on the relative effectiveness of different testing methods for smoke markers. Last year's international ring test on smoke analysis of wines was extended to a pilot study of the variation between international laboratories measuring smoke markers in dried grape material. The success of this pilot study has led to the funding of a major proficiency testing round for analysis of grape material with 20 international laboratories across four continents. This testing will take place before the end of 2023 and will further inform best practice in the analysis of smoke markers.

## Collecting and disseminating information on agrochemicals

### Background

Governments around the world monitor residues of agrochemicals and set limits for the amounts that are legally allowed in foods and beverages. Up-to-date information on agrochemical management is needed to ensure that finished wines meet these limits and do not encounter trade barriers. This project aims to assist grape and wine producers to manage agrochemical residues in their products. This is achieved by collating and providing accurate and timely information on regulatory and technical aspects of chemicals registered for use in Australian viticulture and the maximum residue limit (MRL) requirements of those chemicals in domestic and key export markets.

The project collects data on the agrochemicals registered for use and procures data from spray diary providers and other sources. This data is useful in identifying trends in chemical use and monitoring the status of the pest and disease issues faced in Australian viticulture. Identifying ways to use and share the data with external bodies using FAIR principles is recognised as being a potential benefit to the broader industry.

### Providing information and working for the sector

The project team reviewed the latest information on agrochemicals by liaising with regulators, chemical manufacturers, suppliers and end-users. Best-practice recommendations were then incorporated into a new version of the publication *Agrochemicals registered for use in Australian viticulture* (commonly known as the 'Dog book'), prepared

for publication early in 2023/24. Updates were also made to the online search portal and the agrochemical app, and an electronic version of the 'Dog book' was made available through the AWRI website.

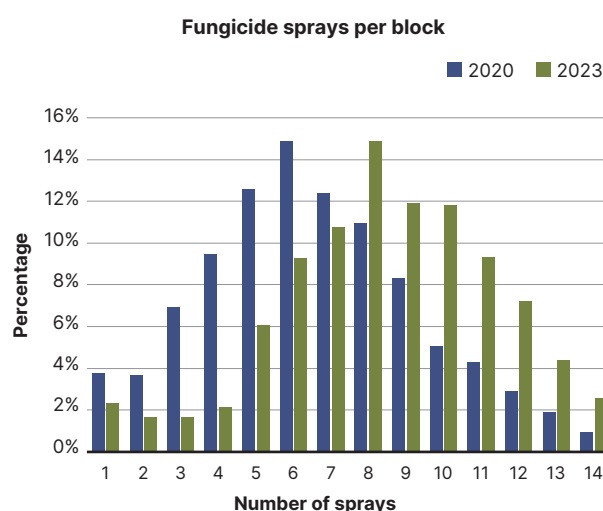
Three new active constituents (cyflumetofen, flazasulfuron and fluoxapiprolin) were registered for use in wine-grape production. Because the compounds had not previously been used in viticulture in Australia in circumstances where the active ingredients would contact grapevines, data on fermentation impacts, sensory effects and residues were required to assess the suitability of these compounds for use in wine-grape production. Decisions about withholding periods to be included in the 'Dog book' were made by the Agrochemicals Reference Group.

Information on agrochemicals or pest and disease issues was provided to stakeholders via eight *eBulletins*, including one in October 2022, which discussed the registration of a new active constituent for downy mildew. Project staff also worked with chemical suppliers to identify active constituents that are not registered for use in viticulture, but which might be useful if registration could be obtained. This process resulted in three chemical companies identifying an active constituent that might have a use in viticulture to control a pest or disease problem.

### Responding to weather conditions

A combination of weather factors, including a La Niña event that re-developed at the start of spring and a negative Indian Ocean Dipole in winter and spring, resulted in more than double the 1961–1990 average national rainfall. These types of conditions reliably result in high disease pressure, prompting action from project staff. Applications for emergency use permits were submitted and approved for products containing active constituents that were in short supply. This alleviates pressure by providing more options for growers to access agrochemicals. Several *eBulletins* warning about disease pressure and providing information about control measures were distributed. Figure 1 compares fungicide sprays applied in the 2020 and 2023 seasons, based on GrapeWeb spray diary data. The increase in sprays in the 2023 season is reflective of the wetter conditions.

The cool and wet weather also created conditions that were favourable to the build-up of *Pseudomonas syringae* pv *syringae*. Symptoms of this bacterial infection mimic those of downy mildew in causing necrosis and rot of inflorescences. A fact sheet and *eBulletin* were prepared and distributed to raise awareness about this disease.



**Figure 1.** Comparison of fungicide sprays per block from two contrasting vintages based on GrapeWeb data. The distributions show more sprays per block required in the wetter season, due to the increased disease pressure and grower interventions to protect the crop. The percentages shown reflect the proportion of total blocks from which data was reported.

## Extension, adoption and education

*The full value of research and development is only realised in industry when outcomes are effectively and efficiently implemented by practitioners. For this to occur, both extension and support for adoption or practice change are required. Projects under this theme apply a range of proven mechanisms to communicate research outcomes, solve industry problems, provide access to relevant technical resources, educate and train students, foster industry adoption and bridge gaps between research and practice.*

### Staff

Dr Valeria Bellan (from 24 October 2022), Linda Bevin, Francesca Blefari, Maria Calabrese (from 20 March 2023), Cerys Colquhoun, Ben Cordingley, Adrian Coulter, Geoff Cowey, Robyn Dixon, Rosanne Dunne, Marcel Essling, Thomas Hensel, Prof. Markus Herderich, Matt Holdstock, Alishia Izzo (from 5 August 2022 to 17 November 2022), Dr Mardi Longbottom, Anne Lord, Clara Moutakis (from 30 November 2022 to 2 March 2023), Dr Simon Nordestgaard, William McSorley, Chris Penfold, Liz Pitcher, Dr Amy Rinaldo (to 24 March 2023), Ella Robinson, Christa Schwarz, Jessica Scudds, Con Simos, Dr Eric Wilkes.

### Collaborators

Agriculture Victoria (Dr Sze Flett, Jeremy Giddings, Megan Hill); Apple and Pear Australia (Ian Cover); Australian Mango Industry Association (Marine Empson); Australian Table Grapes Association Inc. (ATGA) (Jeff Scott); Avocado Australia (Flora Zhang); Barossa Grape & Wine Association (Ashleigh Fox); Berries Australia (Jen Rowling); Brown Family Wine Group (Brett McClen); Chalmers Wines (Kim Chalmers); Rae Clark; Gemtree Wines (Melissa Brown); James Anthony Consulting (Zachary Bailey, Martin Ruiz); Langhorne Creek Wine Region (Lian Jaensch); Leask Agri (Richard Leask); Limestone Ridge Vineyard (Brian Caddy); M. Hill Consulting (Megan Hill); Mornington Peninsula Vignerons Association (Olivia Barrie, Tyson Lewis); Mount Langi Ghiran (Elizabeth Ladhams, Damien Sheehan); Murray Valley Winegrowers (Paul Derrico, Stuart Putland); Pendu Australia (Mintu Brar); Pernod Ricard Winemakers (David Allen); Queensland Wine Industry Association (Andrew Harrigan); Riverland Wine (Charles Matheson); Sherwood Estates (Brett Proud); Summerfruit Australia (Guy Rischmueller); state and regional wine industry associations; Tamburlaine Organic Wines (Martin Gransden, Andrew Higgins); The Australian Melon Association (Joanna Embry); Treasury Wine Estates (Catherine Kidman, Angela Pomery); University of Adelaide (Dr Sue Bastian, Prof. Tim Cavagnaro, Dr Christopher Ford); WBM (Anthony Madigan); Wine Australia (Hannah Bentley, Drea Hall, Jo Hargreaves, Sharon Harvey, Jacquie van Santen); Wine Communicators of Australia (WCA) (Prue Kline); Wine Network Consulting (Samantha Scarratt); Wine Victoria (Stephanie Duboudin, Richard Howden, Damien Sheehan); Wines of Western Australia (Larry Jorgensen); Winetitles (Harrison Davies, Sonya Logan, Hans Mick).

## Improving viticulture and oenology practice through extension, communication and education

### Background

The Australian wine sector operates in a dynamic and competitive environment and it is critical that producers have up-to-date information and support to ensure that their practices are sustainable, efficient and competitive. This extension and communication project uses a range of platforms to facilitate early awareness of research findings, adoption of new technologies, and practice change, all of which contribute to improvements in sustainability and competitiveness. The project liaises with stakeholders to identify and implement opportunities for practice change and co-designs targeted extension and adoption plans. It also develops new content to support both awareness-raising and practice change objectives, and delivers information via a diverse range of platforms, events and programs.

The three practice change priorities currently in focus within this project are:

- improving irrigation efficiency in warm inland regions
- the use of oxygen (aeration) during fermentation
- increasing tropical fruit flavour in the vineyard via foliar sprays.

### Roadshow seminars and workshops

Five seminar events and four workshops were delivered in 2022/23 (see Appendix 2 for details). The roadshow seminars presented updates across a range of grape and wine science topics, while the workshops provided hands-on practical components for both winemaking and viticulture. Three of the workshops delivered were on spray application, covering both practical and theoretical aspects of correctly setting up and using spray equipment. The majority of these workshops were conducted in the vineyard and included live demonstrations and hands-on activities. The fourth workshop, held in Margaret River, included content and tastings from two practice change themes: aeration during fermentation and foliar sprays to boost flavour. This workshop also involved a local winemaker who described their approach to using aeration during fermentation. Evaluations of outcomes from these workshops were conducted and are discussed later in this section.

### Practice change priorities

During the year a range of extension activities were delivered related to the three practice change themes. There was also an increased focus on evaluating the practice change activities delivered.

### Improving irrigation efficiency in warm inland regions

The 2022/23 growing season presented significant challenges to grapegrowers in Australia's inland regions, including floods, plummeting grape prices, disease pressure and high numbers of vineyards without grape supply contracts. Consequently, growers demonstrated limited interest in participating in activities designed to alter their irrigation practices. In response, an opportunity was identified to conduct a comprehensive review of the impact of the activities conducted to date in the irrigation practice change project. This review was conducted in late 2022, with guidance from extension expert Megan Hill from M. Hill Consulting. Key review findings were as follows:

- The workshops exceeded the original participation goal, with 75 attendees surpassing the anticipated 50.
- Attendees had diverse motivations for participation. Factors that contributed positively to practice change included:
  - Enhancing participants' learning and knowledge.
  - Allowing participants to test and validate their existing knowledge.
  - Using the workshops for staff education.
  - Encouraging informal learning, information sharing, and collaborative problem-solving among participants and between participants and expert presenters.
- The range of online resources created within the project, including fact sheets, webinars and podcasts, offered opportunities to convey complex technical information while accommodating different learning styles.
- Written and video web resources were frequently used to complement staff training, whereas case studies were used less frequently.
- Overall, the online resources developed within the project were found to be a sound investment, with usage statistics showing they were being discovered and used by industry stakeholders.



Throughout the review, it became apparent that the industry had undergone significant changes since the project's initiation in 2020. Notably, there had been a shift in the demographic composition of growers in the Riverland region, with a substantial influx of Punjabi individuals, representing approximately 16% of Riverland growers, second only to the Greek community at 17%.

Considering this demographic shift, the project's focus has pivoted towards engaging with the Punjabi grower community by initiating dialogues with community leaders. These discussions have provided valuable insights and deepened the team's understanding of the opportunities and challenges associated with promoting practice change within this group. One significant revelation from these conversations is the language barrier, which has been recognised as an opportunity for driving practice change through the translation of fact sheets and videos.

Additionally, given the mounting pressure on growers to reduce costs and the wine industry's collective commitment to reducing its carbon footprint, a case study has been developed on solar irrigation as a cost-effective, carbon emission-reducing solution. Providing growers with information about grants available to support the transition to solar irrigation has also been recognised as important, and this will be incorporated into next year's activities.

The project team has also actively engaged with the One Basin CRC to ensure that the wine industry leverages the resources and benefits offered by this initiative.

#### Use of aeration during fermentation

A review was conducted on activities delivered in the first phase of work on this practice change area. Results showed that the AWRI aeration webpage, which contains all the resources that have been collated on the topic, is found and valued by the industry. As part of the review, a series of phone interviews was conducted, which identified that stakeholders would like more information on available equipment and engineering solutions for retrofitting existing equipment, with cost and lack of knowledge on modification of equipment emerging as barriers to practice change.

A recently developed monitoring and evaluation framework (see the next project report on behavioural science for more information) has been applied to this project, by including a two-step evaluation of the expected behavioural change. Attendees at the Margaret River workshop were surveyed immediately after the event and then re-contacted after vintage to discuss whether they applied the techniques explained during the workshop. Out of 14 attendees, 9 people agreed to be re-contacted. The evaluation was then extended to AWITC workshop participants (n=48, 7 responses, but 3 duplicates from the original survey). In conclusion, of the 13 people surveyed, 8 did try adding oxygen or air to their ferments during the 2023 vintage as a consequence of attending the workshop. Of the remaining 5, 3 were already adding oxygen but thoroughly enjoyed the workshop, one person mentioned it didn't suit their winemaking style, and one person did not provide further details. In order to provide a better evaluation, the response rate will need to be significantly increased; however, at the same time, an analysis of the market segment will be conducted to realistically identify the market size (i.e. what are the drivers of applying these techniques and, therefore, how many winemakers might actually be interested in applying them).

#### Foliar sprays to increase flavour potential

Development and delivery of content on the use of foliar sprays to increase flavour potential in grapes commenced this year. A short instructional fact sheet was developed and provided to growers who had been identified as willing to be involved in trials during vintage 2023. Four growers committed to work with the AWRI in foliar spraying sections of their vineyard to boost thiol concentrations in resulting wines. Four sets of wines (control + treated) from different regions were made and analysed for key thiols. These wines will be used in workshops later in 2023. The trials were conducted on two varieties: Sauvignon Blanc (three vineyards) and Pinot Gris (one vineyard). Workshops will include tastings and incorporate, where

possible, the growers involved in the trials to provide their perspective on why they chose to be involved and what benefits they saw from this vineyard technique. Suppliers will also be invited to workshops, where possible, to help share the messages being conveyed to their regions. Follow-up evaluations will be conducted with workshop attendees to understand the lessons learned from attending the workshops, and then post-vintage 2024 to find out how many participants changed their practices.

#### Webinars

Twenty webinars were presented to a total of 1,667 attendees in 2022/23. Webinars covered a wide spectrum of topics across oenology and viticulture, as well as seasonal technical topics, updates on Sustainable Winegrowing Australia, the 2022 National Vintage Report and climate outlooks for the months leading into and throughout vintage. The portfolio of presenters was diverse, with 70% of the sessions presented by non-AWRI staff. The most popular webinar during the year (with 146 attendees) was titled 'Regenerative viticulture – what, how and why?', presented by Richard Leask (Leask Agri) and Dr Adam Canning (Charles Sturt University). Each webinar is recorded and uploaded to the AWRI YouTube channel post-presentation, and in the past year, the 20 videos have attracted a combined 13,400 views. The webinar with the single highest number of views was also the one on regenerative viticulture, with more than 2,400 views between November 2022 and June 2023. The AWRI also provided technical support and hosting of the WCA webinar program and continued to enhance and support the WCA website.

#### Podcasts

The second series of 'AWRI decanted' was completed during the year, with six episodes released between July and September 2022. Episodes covered topics in viticultural research including non-chemical weed control, soil carbon and vineyard automation, and also featured practitioners who were putting the research into practice in their businesses. All episodes of the first two series of AWRI decanted are freely available via podcast apps.

#### Educational courses and events

The AWRI delivered three Advanced Wine Assessment Courses, two Advanced Viticulture Courses and the inaugural Advanced Wine Technology Course during the year. This new course covered topics including NOLO wine and spirits production, winery technology to improve energy efficiency, automation, sensory technology, clarification and filtration, packaging, and innovations from other food and beverage industries. Several tailored sensory courses focusing on flavours, taints and faults were also presented.

#### AWRI website

The AWRI website is an important platform for communicating with a wide range of stakeholders. A major change to the AWRI website this year was the migration of previous AWRI Commercial Services content to the new Affinity Labs website at the time the new identity for AWRI's commercial activities was launched. Customers were redirected to the new website from 1 July 2022. The change has not had a major impact on the usage of the AWRI website, with more than 228,750 visitors accessing the AWRI website during the year (5,000 users more than previous year) and 631,560 page-views. A total of 16,720 users visited the new Affinity Lab website this year and it received 190,210 page-views.

Technical updates to content on the AWRI website included new fact sheets on managing waterlogged vineyards and bacterial inflorescence rot. New information was added on grapevine viruses, yeast propagation, disease assessment, *Brettanomyces* and NOLO winemaking, as well as a range of new 'Ask the AWRI' and *Technical Review* articles and research updates on all projects. The website was also used to communicate with levy payers about AWRI Board vacancies and elections, recently published research articles, and events including seminars, workshops, podcasts, tastings and webinars.

## eBulletins and eNews

Twenty-six *eBulletins* were delivered to approximately 3,170 subscribers during the year, providing timely information on technical issues, agrochemical updates, the release of issues of *Technical Review*, and the webinar program (Table 1). Five issues of the AWRI's electronic newsletter, *eNews*, were distributed to an audience of more than 3,550 subscribers. This publication provides a range of information to AWRI stakeholders, including on upcoming events, recently published research, new information resources and sustainability updates.

**Table 1.** *eBulletins* issued during 2022/23

Date	Topic
8 Jul 2022	Five new AWRI webinars – registration is open now
13 Jul 2022	Applications closing soon for AWRI Director and Chair positions
24 Aug 2022	Registrations are open for the next five webinars
25 Aug 2022	<i>Technical Review</i> August 2022 issue available online
20 Sep 2022	Help build a picture of vineyard and winery practices in Australia
4 Oct 2022	Reminder re: vineyard and winery practices survey
10 Oct 2022	Registrations are open for the next seven webinars
27 Oct 2022	<i>Technical Review</i> October 2022 issue available online
27 Oct 2022	Agrochemical update – new active constituent
27 Oct 2022	A wet season update – managing downy mildew and other fungal diseases
4 Nov 2022	Agrochemical update – temporary change to Ontario's MRL for phosphorous acid
8 Nov 2022	AWRI Board election – candidate withdrawal
9 Nov 2022	Managing waterlogged vineyards – new fact sheet
10 Nov 2022	Agrochemical update – emergency use permit for metalaxyl products
25 Nov 2022	Warning about high disease pressure
7 Dec 2022	Agrochemical update – emergency use permit for Nufarm Amishield fungicide
20 Dec 2022	<i>Technical Review</i> December 2022 issue available
21 Dec 2022	Christmas closure
22 Feb 2023	Tips on assessing fruit condition in a season with high disease pressure
28 Feb 2023	<i>Technical Review</i> February 2023 issue available
19 Apr 2023	Bacterial inflorescence rot – one possible cause of inflorescence rot or necrosis
28 Apr 2023	<i>Technical Review</i> April 2023 issue available
19 Jun 2023	Winter webinars starting soon!
21 Jun 2023	Seeking two non-executive Directors
22 Jun 2023	Agrochemical update June 2023
29 Jun 2023	<i>Technical Review</i> June 2023 issue available

## Social media and video content

The AWRI's Twitter/X audience remained steady during a year of change for that platform and the AWRI's Facebook presence continued to grow, reaching ~2,700 followers. The AWRI's YouTube channel offers webinar recordings and other AWRI video content. The channel gained more than 1,214 new subscribers during the year to reach a total of a total of 5,314 by 30 June 2023. There were 259,579 views of videos on the channel and a total watch time of 20,300 hours. Twenty webinar recordings were uploaded to YouTube during the year, with topics including regenerative viticulture, trunk disease, soil health, NOLO winemaking and next generation wineries proving the most popular.

## Annual report

For the past 68 years, the AWRI has produced a printed annual report as its formal report to Australian winemakers and grapegrowers. Since 1999, the annual reports have also been made available on the AWRI's website. The AWRI publishes a summary of the annual report in the *Australian & New Zealand Grapegrower & Winemaker* and offers to deliver an annual presentation to the board or executive of each major state-based winemaking body. This formal activity complements the wide range of other extension and communication activities undertaken by AWRI staff members throughout the year (see Appendices).

## Technical Review

A new completely online format for the AWRI's publication, *Technical Review*, was launched in August 2022. This publication includes titles and abstracts of recently published grape and wine science literature, curated to ensure relevance to Australian grape and wine producers. It also features technical articles authored by AWRI staff. Members of the industry can request a copy of non-open access articles from the AWRI library. The number of articles accessed via *Technical Review* increased by 24% to 3,648 articles read online or provided to readers by library staff during the year.

## Editorial support

The AWRI contributes regular articles to *Wine & Viticulture Journal* and *Australian & New Zealand Grapegrower & Winemaker*, while also contributing to other Australian and international industry journals. Details of all articles published are included in Appendix 7.

## Media liaison

The AWRI is regularly approached by media organisations in Australia and around the world for comment on technical issues related to wine. Four media releases were prepared and distributed, with 23 media interviews conducted during the year (Appendix 6).

## Applying behavioural science to support extension, adoption and practice change

### Background

A new behavioural science capability at the AWRI was created to provide guidance, structure and rigorous methodology for the design and evaluation of extension and adoption programs to improve rates of practice change. The AWRI's new behavioural scientist, Dr Valeria Bellan, supports staff in the design, evaluation and monitoring of projects, as well as offering specific insights drawn from the fields of education, psychology and cognitive neuroscience. This new capability is enhancing the quality of extension, adoption and practice change programs, ensuring they achieve the greatest possible impact within industry.

### Learning style survey

Between November and December 2022, the learning style of a small sub-sample of levy payers (n=80) that attended workshops and seminars was investigated. The results of the survey suggested that:

- More attention should be paid to the comfort of venues used for educational events.
- Participants favour events that facilitate spontaneous networking.
- Participants favour events that include practical activities as much as possible.
- Additional attention should be given to the nature of the presentations delivered and the presenters' engagement skills (with additional training provided if necessary).
- If and when it is possible, participants prefer face-to-face events to online ones.
- If presentations are delivered online, the presenter should be visible during the talk.

These findings are now being taken into account in the design of AWRI educational events.



### New monitoring and evaluation strategy

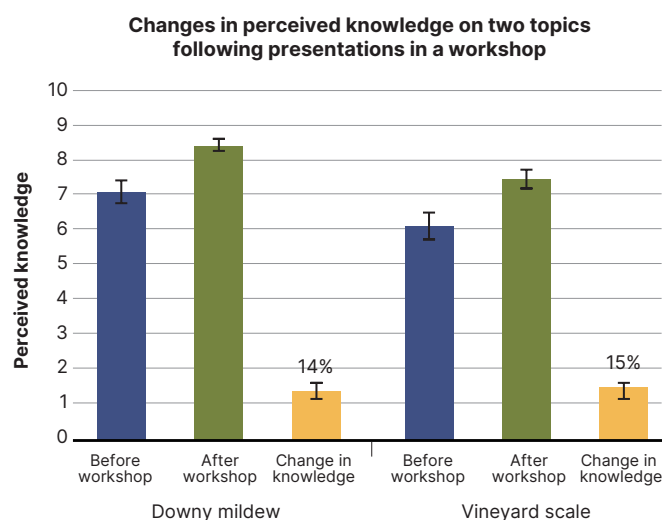
A new strategy to evaluate and monitor webinars, seminars and practice change activities was developed during the first months of 2023. The aim is to provide structure and a rigorous methodology for the evaluation of events as well as to monitor the behavioural change potentially propelled by these events over time.

A revised end-of-event survey was designed, trialed and implemented. This new version offers a better focus on the demographic data of the attendees and their potential for behavioural change. In addition to questions about participants' level of satisfaction, some questions exploring the participants' background were also included, to allow for a clearer picture of the stakeholders that attend AWRI events. Below is an example of the type of data collected during a recent workshop (Table 2).

**Table 2.** Example of data collected from the new end-of-event survey developed within the behavioural science project

	<b>Total sample size: n=38</b>		<b>n</b>
<b>Age (years)</b>	Less than 29		3
	30 to 39		4
	40 to 49		10
	50 to 59		7
	over 60		14
<b>Current role</b>	Vineyard owner		16
	Viticulturalist, grower, vineyard worker		16
	Consultant		2
	Winemaker/cellarhand		0
	Other		2
	More than one selected		4
<b>Years in current role</b>	Less than 5		8
	5 to 9		7
	10 to 19		5
	20 to 29		6
	More than 30		12
<b>Vineyard size (ha)</b>	<10 ha (micro)		0
	10-25 ha (small)		3
	25-50 ha (medium)		8
	50-100 ha (large)		4
	>100 ha (very large)		15
<b>Winery size (t)</b>	<500 t (very small)		1
	500-2,000 t (small)		3
	2,000-10,000 t (medium)		2
	10,000-20,000 t (large)		0
	>20,000 t (very large)		1

A self-evaluation of the increase in knowledge about the topic was also introduced to the survey. Before ( $T_0$ ) and after ( $T_1$ ) each presentation, participants are asked to rate their perceived level of knowledge of the topic on a scale from 0 (some knowledge) to 10 (advanced knowledge). The first iterations of this method have already provided some insightful data, as shown in Figure 2.



**Figure 2.** Example of data collected during a workshop, with the average perceived knowledge (rated on a scale of 1 to 10) before each talk shown in blue and after each talk shown in green. The yellow bars represent the average increase in perceived knowledge.

For the practice change workshops, a further evaluation point was introduced ( $T_2$ ) to follow up on one of the end-of-event questions, specifically 'As a result of what you've heard today, what actions will you take?'. Participants are able to select between four different options that describe different degrees of behavioural change, with the highest being 'I will change at least one of my current practices' and the lowest being 'I will make no changes'. Participants that agree to be re-contacted receive a brief follow-up survey (online or over the phone) after a certain period of time, asking what they decided to do and why. Table 3 shows two examples of  $T_2$  evaluation results taken from an aeration practice change workshop.

**Table 3.** Examples of results from  $T_2$  evaluation of the aeration practice change workshop

#### Example 1 (behavioural change occurred):

**Q:** Did you try adding oxygen or air to your ferments during the 2022 vintage as a consequence of attending the workshop?

**A:** Yes, we did a bit more than we usually do and the workshop gave us more confidence to amp the air up more than we have in the past in our reds. We also tried adding air to our white juice pressings this year after the workshop, and this was very successful and we have achieved an excellent outcome with fruitier and more useful blending options than previous years.

#### Example 2 (behavioural change did not occur):

**Q:** Did you try adding oxygen or air to your ferments during the 2022 vintage as a consequence of attending the workshop?

**A:** No. We mainly do Italian varieties here and the concept of aerating during fermentation does not fit with the strategy we want in our wines. The workshop was good and I attended to essentially see what was going on and if it would fit into our philosophy.

Finally, the materials developed for the practice change projects such as web content, podcasts, fact sheets, case studies and apps, will be periodically evaluated by quantifying the number of views/downloads. These data are considered a good measure of the relative impact of each specific item.

## Development of digital extension tools and software

### Background

The AWRI provides a range of online databases and mobile apps to support Australian grape and wine producers. The uptake of these technologies is high and the demand for technology to improve productivity or promote efficient processes is continuing to increase. This project ensures there is a planned and coordinated approach to the development, delivery and maintenance of innovative and collaborative digital tools.

### Mobile apps

The agrochemical and MRL databases form the core capability behind the 'Dog book', agrochemical and MRL online search functions and agrochemical mobile apps. The agrochemical and MRL online search portal attracted 1,730 users during the year (including 631 new users) and was accessed more than 32,020 times. The winemaking calculators app is one of the AWRI's most popular tools. It helps winemakers conduct a range of calculations needed during wine production, including conversions, additions and label requirements. This year, 639 new users downloaded the winemaking calculators app.

### Horticultural crops mobile apps

A project helping horticultural producers comply with agrochemical residue requirements delivered four apps during the year (available in iOS and Android versions) for use in the avocado, mango, melon and berry sectors. Apps for apples, pears and summer fruits are scheduled to go live in the first quarter of 2023/24.

## ShowRunner

### Background

ShowRunner, a comprehensive show management software system created at the AWRI, encompasses all facets of a wine show, ranging from online entries to electronic scoring and result generation. Initially designed as a custom solution for the Advanced Wine Assessment Course, the software has since evolved to accommodate the specific requirements of the Australian wine show system. Its functionality has also been extended to encompass other uses, such as supporting classification tastings.

### Online platform

Forty shows, totalling approximately 17,000 entries, used the ShowRunner platform in 2022/23. The system now operates as a web-based platform and the team has significantly changed the software to improve access, providing options for show organisers to self-run events and for the ShowRunner team to deliver support remotely. This has allowed clients to deliver their events in a more cost-effective manner.

## Regional engagement

### Background

The AWRI delivers high-quality extension and practice change services to wine-grape growers and wineries across regional Australia through state and regional partnerships. The project team engages with industry and government stakeholders and applies new approaches to putting research into action regionally. This is enabling current gaps to be addressed and helping to prepare vineyards for future priorities, such as climate change, soil health, biosecurity and smoke taint. The choice of topics covered under this project is quite varied and content is drawn from many organisations in order to address topical regional issues.

### Supporting Wine Australia's Regional Program

Extension activities in 2022/23 in the Murray Valley included two workshops on improving soil health and controlling insect pests and a further two workshops focusing solely on soil health. Climate adaptation was a key theme this year, with four workshops delivered in Greater Victoria and one in Western Australia on climate change adaptation in the vineyard. One workshop was delivered on behalf of the Queensland industry on understanding the impact of grapevine viruses and enhancing fruit characters in winemaking. Fifteen external presenters were used in the delivery of these events.

### Wine Victoria 'Growing Victorian Wine into the future'

As part of the first year of the *Growing Victorian Wine into the Future 2022-2026* plan, the AWRI supported the delivery of two program areas. Four workshops were presented covering an introduction to Sustainable Winegrowing Australia and carbon calculations, followed by four workshops on carbon neutrality in the vineyard and winery.





## AWRI helpdesk

### Background

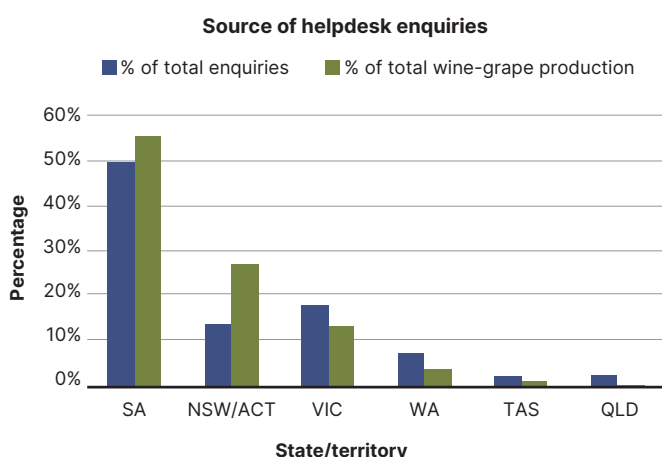
The AWRI's technical helpdesk plays an important role supporting grapegrowers and winemakers across Australia. The helpdesk provides rapid, confidential, technical support on topics across winemaking and viticulture, delivered by an experienced, multi-disciplinary team.

### Helpdesk enquiries

During 2022/23, 1,976 winemaking and viticulture enquiries were received by the AWRI's technical helpdesk (Table 4). Note that sustainability-related queries are not included in this tally, but are instead reported and discussed separately in the report for Sustainable Winegrowing Australia. Similar to last year, the number of viticulture queries was high, approximately three times the typical number. This was again due to the cool, wet conditions experienced in many regions. The majority of wine and viticulture enquiries were from grape and wine companies and suppliers actively aligned with the wine industry, with a small number coming from government organisations, students, legal practitioners and journalists. Figure 3 shows that the sources of enquiries were broadly in line with the proportional volume of grapes crushed in each state/territory, with fewer queries than expected from NSW. It should be noted that the volumes of grapes crushed in NSW and Victoria in 2023 were 36% and 40% below ten-year averages, respectively, driven by significantly reduced tonnage in the warm inland regions.

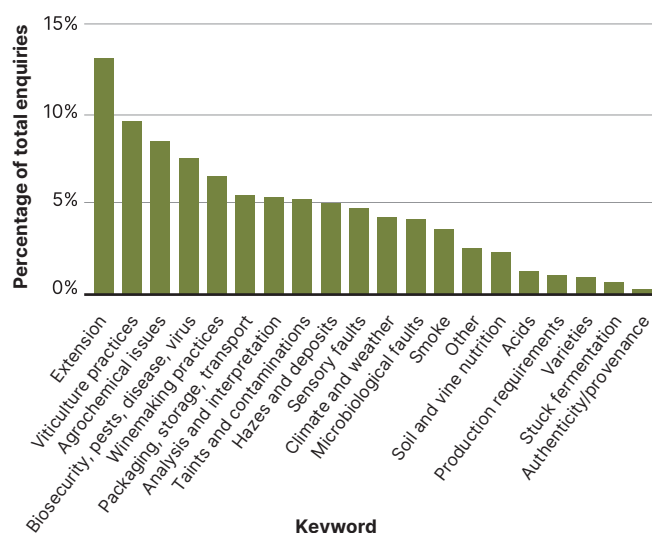
**Table 4.** Winemaking and viticulture enquiries received by the AWRI helpdesk in 2022/23

Topic	Number of enquiries
Winemaking	1,110
Viticulture	886
<b>Total</b>	<b>1,976</b>



**Figure 3.** Enquiries received by the AWRI helpdesk in 2022/23 by state/territory compared to wine-grape production in 2023 (Wine Australia National Vintage Report 2023)

Wine and viticulture helpdesk enquiries are classified using 20 subject keywords. The number of enquiries received under each keyword is compared to monthly historical data collected over more than 20 years, to help identify national, state and regional trends. This allows for prompt responses to emerging issues and timely provision of relevant information. Figure 4 shows the wine and viticulture enquiries from 2022/23 arranged in order from most to least used keyword, highlighting key events or issues of interest during the year. Queries assigned to the keyword 'Extension' were the most common this year. These included requests for presentations, events or training.



**Figure 4.** Winemaking and viticulture enquiries received by the AWRI helpdesk in 2022/23, organised by keywords. Enquiry numbers are represented as a percentage of total national wine and viticulture enquiries, where the total number was 1,976.

### Viticulture enquiries

During the year, the viticulture team responded to 886 enquiries. A high proportion of viticulture queries were in the category of viticultural practices, with pruning and cover crops frequent topics within this category. Due to continuing challenges with oversupply, several regions again requested information and assistance regarding 'resting' vineyards. Viticulturists attended regional meetings on this topic in the Riverland, Langhorne Creek and Limestone Coast. Permits were obtained from the regulatory agency to facilitate the use of ethephon to reduce yields. Queries on agrochemical issues and biosecurity, pests, disease and virus were also prevalent. The wet seasonal conditions and widespread flooding saw increased queries about the control of downy mildew, *Botrytis* and bacterial inflorescence rot. Queries about scale insects were received throughout the 2022/23 season. In response, the viticulture team collaborated with AWRI researchers on a monitoring project, reported below under investigations.

### Winemaking enquiries

During the year, the winemaking team responded to 1,110 enquiries. Winemaking practice queries were higher than usual but with no particular trend in terms of topics. Queries covered practices including malolactic conversion in wines with high acidity; yeast assimilable nitrogen and nitrogen alternatives; timing of tannin additions; amber wines and skin contact in white wine production; sherry production; fortification; production of NOLO wines and wine products; addition of oxygen during fermentation; hyperoxidation; clarification and settling; yeast culture propagation; and use of agents such as dimethyl dicarbonate.

Queries about the availability and increased cost of nitrogen fertiliser and additives (urea in the vineyard and diammonium phosphate in the winery) were received from both growers and winemakers. Many food and agricultural sectors had to deal with reduced availability and/or increased cost of nitrogen-based chemicals for the second year in a row. Suppliers were contacted to discuss supply and demand factors and researchers were consulted to discuss alternative products or management techniques. Recommendations were then communicated to the grape and wine sector through two 'Ask the AWRI' columns.

Carbon dioxide (CO<sub>2</sub> or dry ice) was also in short supply this season and selling at around double the usual price. This coincided with the

shutdown of the Torrens Island B power station in Adelaide, previously the biggest supplier of CO<sub>2</sub> to producers in SA, which also had flow-on effects in other states. An 'Ask the AWRI' column was written to discuss best-practice gas headspace management for wine storage.

Smoke taint queries addressed bushfires that occurred in Geographe, WA, in January 2023, as well as smoke from electrical fires in warehouses, packaging halls and wineries, stubble burns and prescribed burns. Due to the generally wetter year and additional vegetative growth, several states again brought forward prescribed burns into early autumn, which caused concern for growers whose fruit remained on the vine at that time. The AWRI worked with state and regional bodies to provide accurate information on prescribed burns and their impact on viticulture to support communications with organisations conducting such burns.

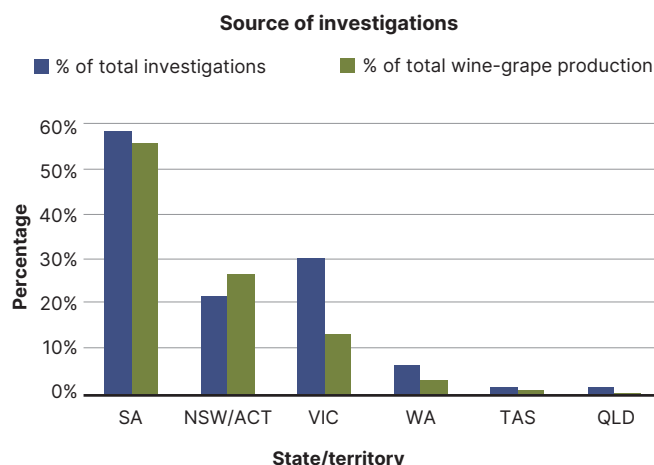
Packaging, storage and transport queries this year included wines affected by flooding. Several winery cellars located close to rivers became flooded when floods affected wine regions in SA and the eastern states. The helpdesk investigated affected wine stored in both bottles and barrels that became submerged during the floods. Rising water tables in some regions also resulted in some vineyards being affected by rising salinity which later affected the wine produced.

### Winemaking and viticulture problem-solving investigations

This year 14% of winemaking enquiries resulted in investigations, where samples were required for analysis to identify the problem and recommend a solution. The helpdesk team conducted 153 problem-solving investigations on 793 samples (Table 5). As with enquiries, use of the problem-solving investigative service was mostly in line with the proportional volume of wine-grape plantings for each state or territory (Figure 5).

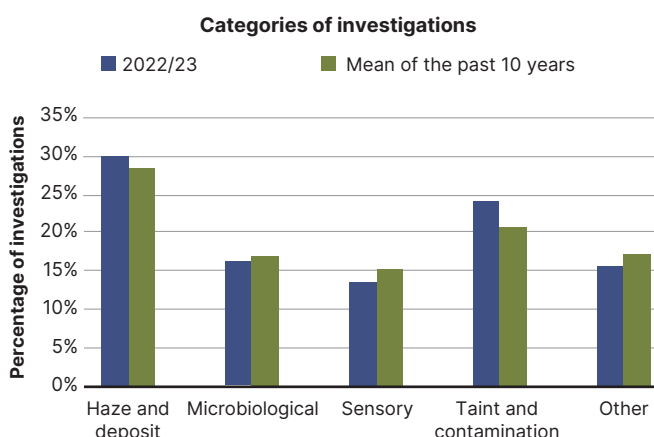
**Table 5.** Investigations conducted and samples analysed by the AWRI helpdesk in 2022/23

Type of investigation	2022/23
Hazes and deposits	46
Microbiological issues	25
Sensory investigations	21
Taints and contaminations	37
Other investigative analyses	21
Viticulture-related investigations	3
<b>Total number of investigations</b>	<b>153</b>
<b>Total number of samples analysed</b>	<b>793</b>



**Figure 5.** Investigations undertaken by the AWRI helpdesk in 2022/23 by state/territory, compared to wine-grape production in 2023 (Wine Australia National Vintage Report 2023)

Helpdesk investigations are assigned to five main categories: hazes and deposits; sensory investigations; microbiological issues; taints and contaminations; and other (which includes viticulture investigations). The proportion of investigations in each category has remained relatively consistent over the last ten years, with approximately 20% in each category (Figure 6).



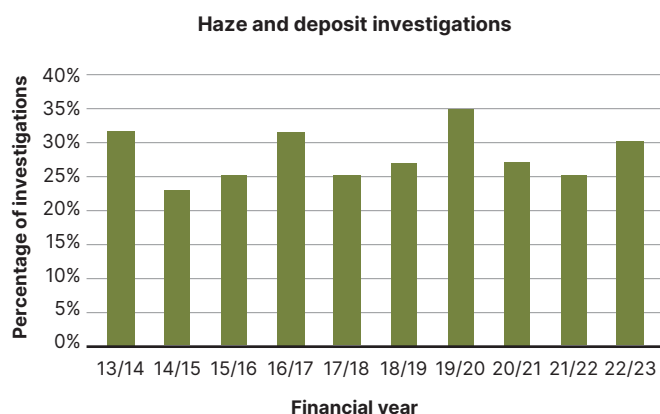
**Figure 6.** Distribution of helpdesk investigations across five main categories. For 2022/23 the total number of investigations was 153.

### Hazes and deposits

The proportion of haze and deposit investigations this year was similar to previous years (Figure 7); however, there were fewer than usual post-packaging heat and cold instabilities. Of the 14 cold instability investigations conducted, 11 were due to calcium-L-tartrate instabilities. Calcium-based crystalline instabilities have been steadily increasing each year, occurring in wines from warmer regions rather than the cooler areas where they have typically occurred in the past. The mean concentration of calcium in both red and white wines has also been steadily increasing in wines analysed through Affinity Labs. Four instances of quercetin instabilities in wines were also seen this year. Several colour instability investigations related to pinking occurring in 2022 vintage wines. Other deposits found in wines included tirage residue on bottles, bottle lacquer and bottle bloom, cork treatment material, rubber O-ring fragments, cellulose fibres, metal residues in brine, and copper residues in wine products.



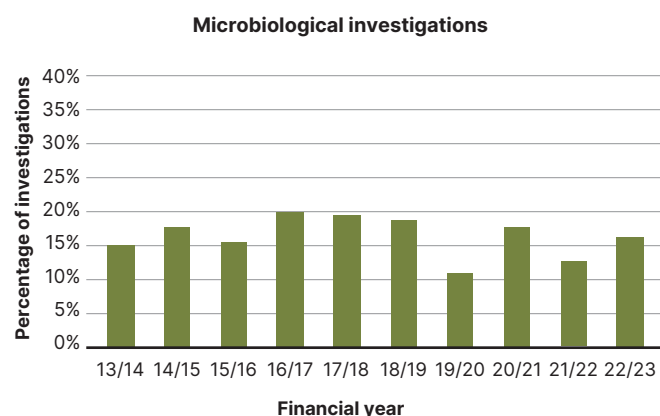




**Figure 7.** Haze and deposit investigations conducted by the AWRI helpdesk from 2013/14 to 2022/23

### Microbiological issues

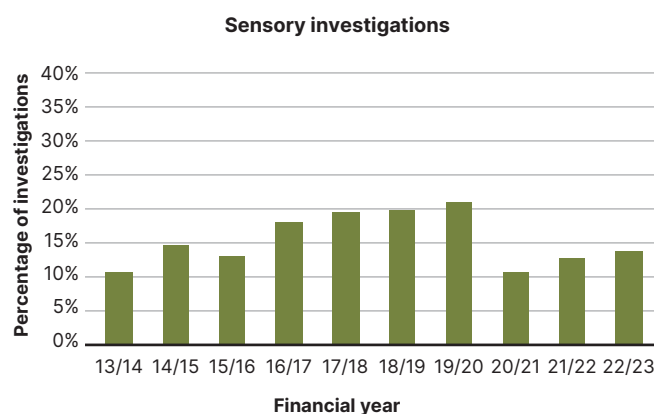
The proportion of microbiological investigations was similar to previous years (Figure 8). Investigations mainly concerned yeast refermentation in packaged wine and filtration integrity breakdowns.



**Figure 8.** Microbiological investigations conducted by the AWRI helpdesk from 2013/14 to 2022/23

### Sensory investigations

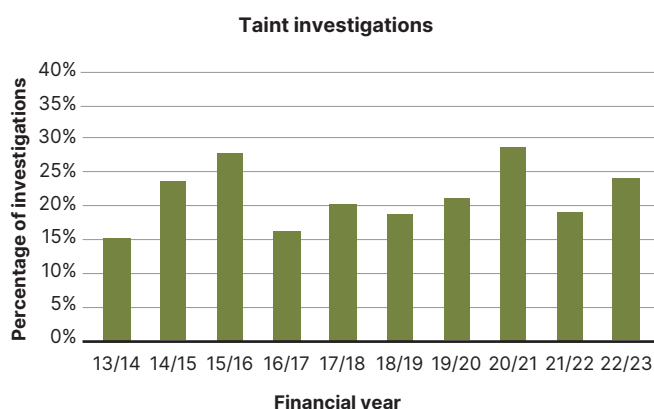
For the last three years there has been a lower proportion of sensory investigations than average (Figure 9). Sensory investigations this year were equally split between wines with sulfides and wines showing oxidation. Several investigations were initially thought by clients to be cases of *Brettanomyces* spoilage, but sensory assessment revealed clear 'reductive' wine faults. Confusion between *Brettanomyces* characters and 'reductive'/sulfide wine faults, although quite different in aroma, was quite common in the early 2000s before taint and fault tastings were offered throughout Australia as part of the AWRI roadshow program. Such confusion also still often occurs internationally at wine shows. One other sensory investigation found saltiness derived from vineyards affected by floods, which had caused salt to rise from the water table into the grapevine root zone and subsequently affect the vine, fruit and wine produced.



**Figure 9.** Sensory investigations conducted by the AWRI helpdesk from 2013/14 to 2022/23

### Taints and contaminations

The proportion of taint and contamination investigations was elevated this year (Figure 10). There were eight investigations of smoke taint in wines, where smoke was derived from electrical fires or other fires occurring in warehouses, barrel halls or packaging lines, or where fuel sources were material other than wood. Smoke taint was also investigated in fruit affected by stubble or prescribed burns that occurred in March when fruit was still on the vine due to the later harvest. Wine quality stored in barrels was investigated after several wineries had their cellars flooded with flood waters. Hydrocarbon taints were investigated following the laying of bitumen roads near vineyards over the ripening period. The number of hydraulic oil leaks, brine contaminations or burnt-out pumps investigated over vintage was fairly typical. Two separate investigations examined 'musty' taints observed in large format oak vessels. There were also two investigations of metal contamination in wine caused by poor-quality metal ties being used to hold together barrel inserts, with the acidity of the wine corroding the metal.

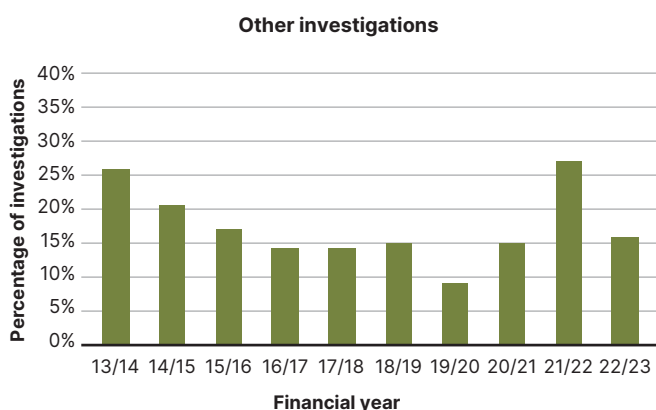


**Figure 10.** Taint-related investigations conducted by the AWRI helpdesk from 2013/14 to 2022/23

### Other investigations

Investigations classified as 'other' this year (Figure 11) included an examination of vineyard scale insects isolated at the end of the 2022 season, in a collaborative project conducted with AWRI researchers. Metagenomic-based ecosystem monitoring was used to detect and quantify key species of scale, parasitoids and other associated insects from scrapings of scale-infested vines collected from eight vineyards across South Australia. The discovery of *Parthenolecanium corni* as a significant member of scale infestations confirmed empirical observations of scale with two or more cycles of offspring per year within Australian vineyards. This finding has significant implications for the development of effective control strategies for this group of pests.

During 2023, cases of necrosis and rot of inflorescences were investigated. These symptoms could be caused by a physiological disorder or fungal infection but could also be the result of bacterial inflorescence rot, which is caused by the bacterium *Pseudomonas syringae* pv. *syringae*. This is a low-risk pathogen in dry and warm seasons, but its development and spread are favoured by wet conditions such as those experienced in the 2023 season. The cooler season also saw some areas struggling to achieve ripeness, which led to three investigations of possible must amelioration or varietal substitution. Packaging-related investigations included gushing in sparkling wine during disgorgement and aluminium leaching from cans into wine.



**Figure 11.** Other investigations conducted by the AWRI helpdesk from 2013/14 to 2022/23

## Library and information services

### Background

The John Fornachon Memorial Library holds one of the largest collections of grape and wine resources in the world, with more than 113,425 print and digital resources on offer via a range of information discovery tools and services. The library supports the Australian grape and wine sector by providing access to technical information that assists learning, understanding and adoption of research outcomes.

### Library resources

During the year, the library added 3,061 new resources (including eBooks, books and articles) to its collection. Users can search for resources via the library catalogue on the AWRI website. A total of 44 new eBooks were purchased and 2,984 book/chapter downloads, online views or pages printed were recorded in the eBooks collection this year.

### Staff publications

The staff publications database, accessible via the AWRI website, holds more than 2,361 AWRI-authored articles. This year, the database received more than 5,119 hits. Many publications are now offered via open access direct to the full-text articles. For non-open access articles, a total of 1,132 staff publications (63% increase from previous year) were requested and delivered under copyright declarations.

### Online information packs

Online information packs are reference lists with a specific topic focus, which provide growers and winemakers with seamless access to highly curated and relevant information. The demand for information packs is continuing to climb, with a 134% increase in the number of articles requested. The library responded to 649 requests and despatched 1,982 articles.



### Library reference and information requests

The library responded to 1,321 requests for information covering literature searches, article and book requests, website content and advice on copyright. A total of 2,592 non-open access articles were supplied (Table 6), an increase of 54% from the previous year. The number of AWRI staff publications requested also jumped from 694 in 2021/22 to 1,132 articles delivered in 2022/23. The previous year's effort to provide direct links to articles available from publishers' websites resulted in users accessing 2,739 open access articles from various online tools on the AWRI website. In total, 5,331 articles were provided or accessed in 2022/23.

**Table 6.** Non-open access articles supplied from library collections in 2022/23

Article type	Number of items supplied
AWRI staff publications	1,132
Technical Review collection	564
Library reprint collection	896
<b>Total</b>	<b>2,592</b>



## Performance, products and processes

*There are numerous processes involved in wine production, from grapegrowing all the way through to delivery of finished product to consumers. Projects under this theme aim to optimise these processes and reduce costs, resulting in overall improvements to wine quality and business sustainability. Specific areas include grape and wine flavour; wine stability and processing efficiency; optimisation of primary and secondary fermentation; development of new winemaking microorganisms; and production of no- and low-alcohol wines.*

### Staff

Sheridan Barter, Dr Marlize Bekker, Dr Jenny Bellon, Eleanor Bilogrevic, Dr Keren Bindon, Dr Anthony Borneman, Dr Peter Costello, Damian Espinase Nandorfy, Assoc. Prof. Leigh Francis, Dr Toni Garcia Cordente, Dr Richard Gawel (to 2 December 2022), John Gledhill, Prof. Markus Herderich, Dr Josh Hixson, WenWen Jiang, Stella Kassara, Allie Kulcsar, Dr Darek Kutyna, Dr Deanna Langone, Desiree Likos, Jane McCarthy, Dr Agnieszka Mierczynska-Vasilev, Dr Cristobal Onetto, Dr Mango Parker, Dr Wes Pearson, Lisa Pisaniello, Song (Luke) Qi, Tim Reilly, Dr Tony Robinson, Dr Simon Schmidt, Alex Schulkin, Dr Tracey Siebert, Mark Solomon, Dr Yihe (Eva) Sui, Don Teng, Dr Cristian Varela, Flynn Watson, Dr Eric Wilkes.

### Students

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### Visiting students

Antonia Boeckel (University of Bonn), Elisabeth Khaikin (University of Bonn), Tabea Soencksen (University of Braunschweig).

### Collaborators

AB Biotech (Anthony Heinrich); Accolade Wines (Vanessa Stockdale); Australian Grape & Wine (Anna Hooper); Australian National University (Prof. John Bekkers); Australian Vintage Limited (Jamie Saint); Burch Family Wines (Richard Burch); CASS Food Research Centre (Assoc. Prof. Robert Shellie); Chr. Hansen (Duncan Hamm, Amanda Tanga); CSIRO (Dr Shaoyang Wang); Deakin University (Prof. Russell Keast); DogRidge (Fred Howard); Domaine Chandon (Kat Herd); DrinkWise (Simon Strahan); Endeavour Drinks Group (Jeff Barter, Michael Calloway, Greg Edwards, Steve Faulkner, Darren Leivers, Claire Maxwell); Firmenich (Nicholas Garfield); Flavourtech (Paul Ahn, Leon Skaliotis); Geoff Flight; Flinders University (Dr Dennis Palms, Prof. Krasimir Vasilev); Fourth Wave Wines (Corey Ryan); Gulbali Institute, Charles Sturt University (Prof. Andrew Clark, Dr Sijing Li, Dr Xinyi Zhang); Hill-Smith Family Estates (Louisa Rose); Hither & Yon (Malcolm Leask); Hochschule Geisenheim University, Germany (Prof. Doris Rauhut); Hugh Hamilton Wines (Nic Bourke, Mary Hamilton); Impact Innovation (Heather Buys, Angus Crossan, Madelyn Goodrick); Indonesian Institute of Sciences, Indonesia (Dr Satriyo Wahono); Laffort (Alana Seabrook); Lallemant (Dr Eveline Bartowsky); Margaret River Wines (Amanda Whitehead); Marks & Spencer, UK (Dror Nativ, Bryony Wilkinson); Mercer Wines (Aaron Mercer); Moorak Wines (Jordan Hein); NSW Department of Primary Industries (Dr Katie Dunne); Orbis Wines (Lauren Langfield); Michael Papageorgiou; Patrilli Wines (Ben Heide); Pernod Ricard Winemakers (Darryn Hakof, Jean Macintyre); Range Life Wines (Cam Marshall); Rathbone Wine Group (Damien Sheehan); Darren Schubert; Seppeltsfield (Fiona Donald); Stellenbosch University, South Africa (Prof. Wessel Du Toit); Tarac Technologies (Amanda Doecke, Greg Jackson); Taylors Wines (Mitchell Taylor); Tolley Viticulture (Simon Tolley); Treasury Wine Estates (Jeanne Cate, James Godfrey, Jorge Henry, Iain Jones, Kym Schroeter, Alison Soden); University of Adelaide (Dr Armando Corsi, Dr Rebecca Dolan, Assoc. Prof. David Jeffery, Dr Richard Muhlack,

Prof. Kerry Wilkinson); University Bordeaux, France (Prof. Philippe Darriet); University of South Australia (Dr Miguel de Barros Lopes); University of Tasmania (Prof. Robert Shellie); VA Filtration/Memstar (Katy Cordova, David Wollan); Vine to Wine to Market NZ (Dr David Jordan); Vintelligence (Lucy Clements).

## Flavour attributes of significance to growers and winemakers

### Background

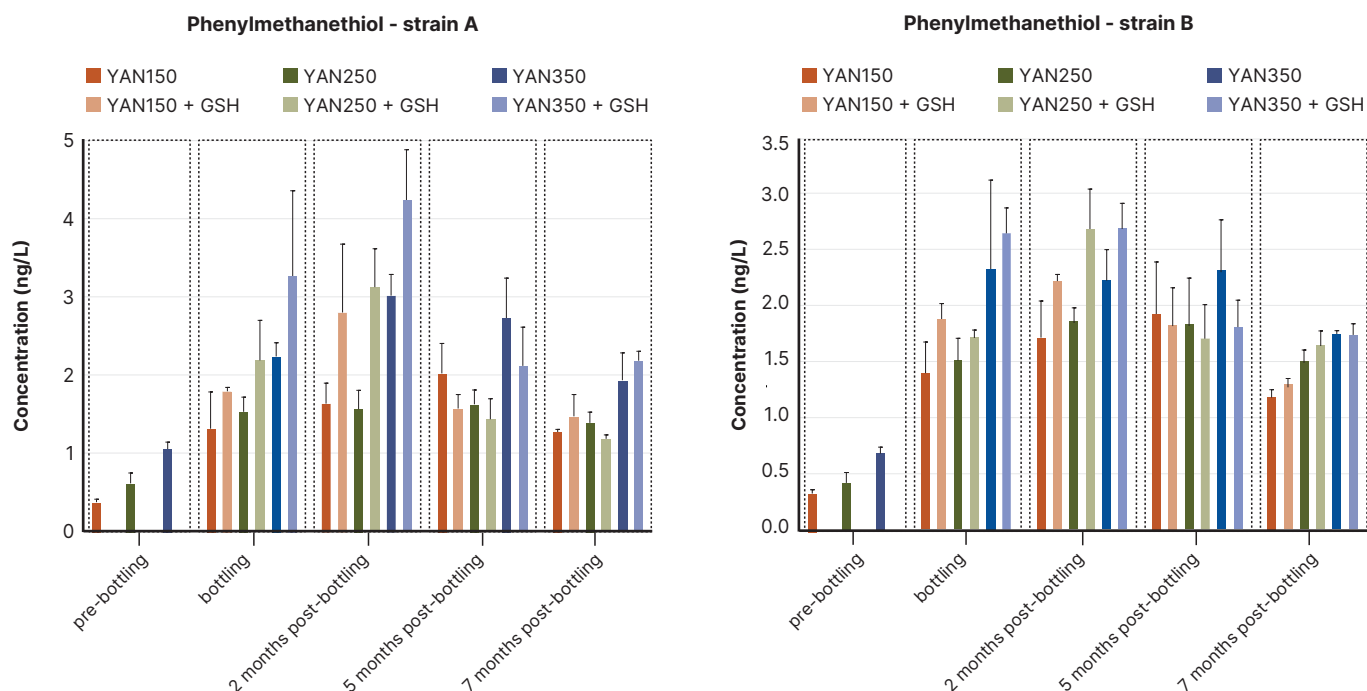
The aroma and flavour properties of wine are essentially directed by a large number of volatile aroma compounds. These compounds have a strong influence of perceptions of quality for consumers and are influenced at every stage of handling or processing. The ability to understand and measure key volatile compounds is important, while developing practices for grape and wine producers to influence flavours associated with wine quality and style.

### Factors that promote 'flint' and 'struck match' flavours

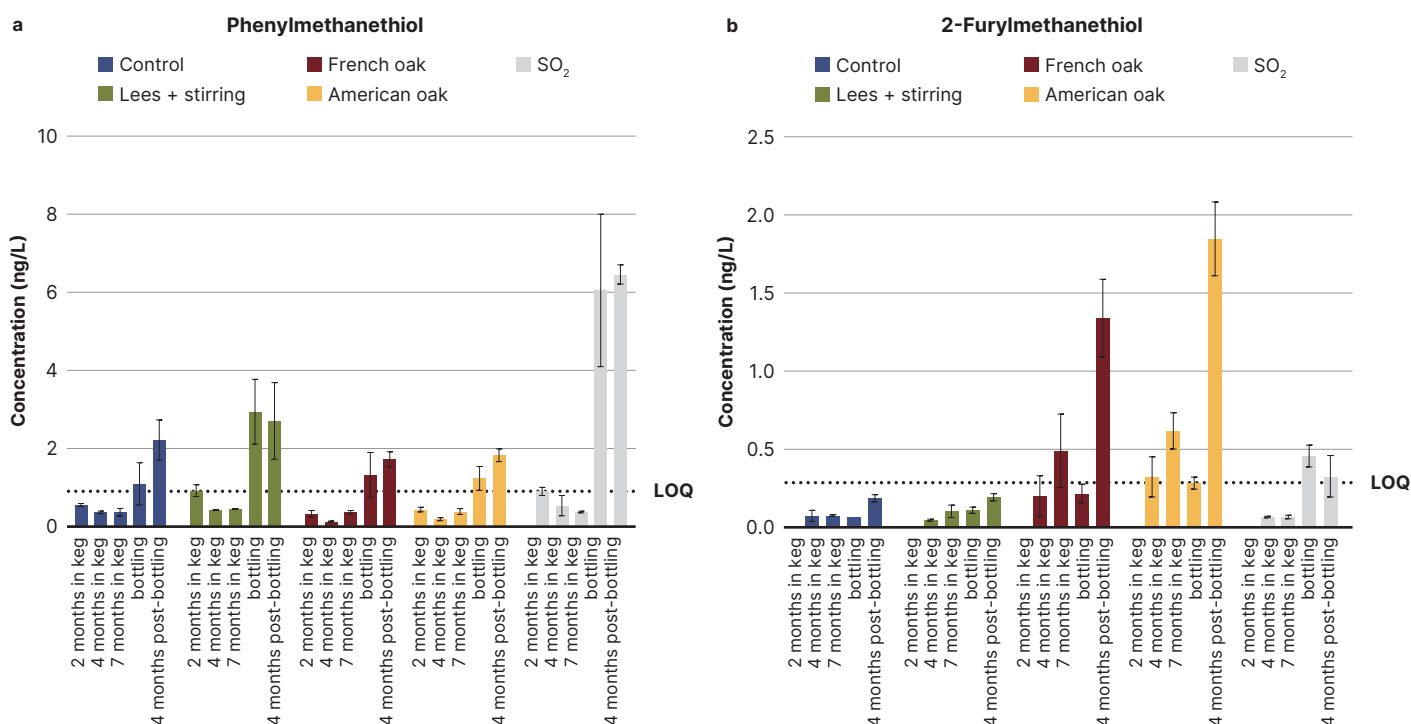
The volatile sulfur compounds phenylmethanethiol (PMT) and 2-furymethanethiol (2-FMT) have been associated with 'flinty' or 'struck match' aromas in wine, and are considered to be important contributors to the flavour of certain white wine styles. The formation of 2-FMT has been well-defined and known to be associated with oak contact; however, little information was known about the factors driving the formation of PMT during winemaking, as well as the pathways that might be involved in its formation.

The biochemical and chemical formation pathways of this compound were investigated, and a range of practical winemaking strategies were found to influence its final concentration in wine. A small-scale (20-litre) winemaking trial with Chardonnay in 2022 confirmed previous observations that diammonium phosphate (DAP) additions to grape must had a positive effect on PMT formation, with the highest levels of this 'flinty' compound in wine observed at a concentration of 350 mg/L of yeast assimilable nitrogen (YAN) (Figure 12). This enhancing effect of YAN on PMT formation was observed for both commercial wine yeast strains trialled, with strain A (AWRI 2865) producing significantly higher amounts of PMT than strain B (AWRI 1616) (Figure 12). These findings confirmed that yeast strain choice and DAP addition could be used to modulate the levels of PMT in wine. In this trial, the addition of the antioxidant glutathione just before bottling was found to have a modest effect on the preservation of PMT in wine up to two months in bottle. This protective effect was no longer observed with extended storage times (after five and seven months) (Figure 12).

Factors contributing to the development of PMT in wine post-fermentation were also evaluated. Treatments such as lees stirring, exposure to American or French oak chips, and SO<sub>2</sub> addition before bottling were all assessed in a Chardonnay wine that was aged in stainless steel kegs for seven months before bottling. It was found that the addition of oak did not significantly increase the concentration of PMT; however, as expected, both American and French oak chips significantly increased the concentration of 2-FMT. Ageing on lees did slightly increase PMT concentration; however, high levels of SO<sub>2</sub> addition at bottling produced the greatest PMT concentration of all conditions evaluated (Figure 13).



**Figure 12.** The concentration (ng/L) of phenylmethanethiol produced in ferments conducted by two different yeast strains and treated with different levels of yeast assimilable nitrogen (YAN) and glutathione (GSH) as measured pre-bottling, at bottling and two, five and seven months post-bottling



**Figure 13.** (a) Phenylmethanethiol (PMT) and (b) 2-furylmethanethiol (2-FMT) concentration measured in Chardonnay wine over the course of 12 months while ageing in stainless steel kegs and up to four months post-bottling. Wines were treated with lees (Lees + stirring, green), French oak chips (French oak, dark red), American oak chips (American oak, yellow), or increased SO<sub>2</sub> at bottling (SO<sub>2</sub>, grey) with the results compared to wine without any treatments (control, blue).

#### Prevalence of oak-related aroma compounds in premium wines

Barrel fermentation and barrel ageing are commonly used practices in premium wine production. The wine aroma compounds related to barrel contact are varied and can enhance a range of wine aromas and flavours, such as 'struck flint', 'caramel', 'red berry', 'toasty' and 'nutty', as well as conventional oaky characters such as 'vanilla',

'spice', 'smoky' and 'coconut'. A survey of commercial premium Shiraz, Cabernet Sauvignon, Pinot Noir and Chardonnay wines produced in Australia was conducted. Thirty barrel-fermented and/or barrel-aged wines of each variety from the 2017 – 2021 vintages were selected, all sealed using screwcap closures. These wines were assessed for the prevalence of compounds that have been proposed as barrel ageing



markers. The compounds investigated included oak lactones, volatile phenols, furanones, aldehydes, thiazoles, phenylmethanethiol and 2-furylmethanethiol.

Accurate quantitative data is necessary to help understand the compounds which might influence these aromas, but their analysis is often not a trivial undertaking. The furanones, especially furaneol, are difficult to measure accurately in wine as they are very polar. Thus, method development was initiated to:

- improve a stable isotope dilution assay using automated liquid–liquid microextraction and multidimensional–gas chromatography–mass spectrometry
- simplify the quantification of the highly volatile and reactive aldehydes using automated headspace solid-phase microextraction and gas chromatography–mass spectrometry with in-vial derivatisation
- quantify thiazoles using gas chromatography–tandem mass spectrometry.

The other targeted volatile compounds assessed for their role as barrel ageing markers were quantified using previously published stable isotope dilution assay methods routinely used at the AWRI. Using the newly developed and further improved methods an increased number of analytes were quantified in 120 wines with minimal sample preparation and in a shorter amount of time. The key findings are summarised in Figure 14. This survey showed that Chardonnay wines had higher concentrations of PMT, 2-FMT and homofuraneol, but lower concentrations of diacetyl. Furfural and 5-methylfurfural were higher in Chardonnay and benzyl alcohol was higher in Pinot Noir. These compounds are not important as aroma compounds but may act as precursors to 2-FMT and PMT. Sotolon was more prevalent in Cabernet Sauvignon and Shiraz wines, whereas methionol was more prevalent in Cabernet Sauvignon wines. Guaiacol and 4-methylguaiacol, compounds associated with smoke taint, were found in most wines but at relatively low concentrations, consistent with knowledge that smoke marker compounds are found in non-smoke-exposed grapes and can also be contributed to wines through contact with toasted oak. A poster on this survey was produced for presentation at the OenoMacrowine 2023 conference.

### Smoke taint

Two key papers from earlier smoke taint research were published this year (Parker et al. 2023 and Bilogrevic et al. 2023 – see Appendix 7). The first describes a study where a comprehensive set of 63 wines (Chardonnay, Pinot Noir and Shiraz) spanning a range of levels of smoke exposure were produced from wildfire smoke-exposed grapes in 2020. The project team were able to link results from grape analysis to the likelihood of perceptible smoke characters in wine. This will help producers to assess grapes that have been exposed to smoke and more clearly understand the risk of producing smoky wine. The study also confirmed that the current suite of 13 smoke exposure markers in grapes can predict smoky flavour in wine.

The second paper reported on three consumer studies assessing the levels of smoke marker compounds in wine that had an impact on consumer liking. Results clearly showed that smoke characters in wine negatively affected consumer liking, across different wine styles. Generally, consumers seemed to fall into one of three main categories: those who were very responsive to smoke characters, those who were moderately responsive to smoke characters and a small percentage who did not respond to smoke flavour at all. The group of consumers who responded most negatively, a sizeable group in each study, were affected by smoke characters at the same concentrations as those detected by trained expert sensory panels. There was no evidence for any consumer group preferring wines with smoke flavour.

### 'Raisin'/'jammy' flavour in Shiraz and other red grapes

The volatile compounds in red wine that are responsible for overripe 'dried fruit', 'jammy' or 'raisin' aromas, especially in Shiraz, are not well characterised. Chemical markers associated with overripe Shiraz were observed in Shiraz grapes from a number of regions, and not necessarily related to temperature or extent of shrivel, as has previously been the case. Instead, these markers were increased in grapes with later harvest dates, even for grapes where a later harvest date resulted from a cooler climate. So, while an earlier focus for this work was on shrivel, this may not be the only factor in the formation of compounds related to overripe characters.

To expand the scope of this work outside Shiraz, the project team is no longer only considering varieties that are known to shrivel, but also those with large commercial relevance due to their percentage of crush. As such, Shiraz, Cabernet Sauvignon, Merlot and Durif were sampled during the 2023 vintage from warm, irrigated regions. While the vintage was atypical, being overly cold and wet, Shiraz grapes still showed significant shrivel. All grapes will be analysed in the coming financial year to understand the presence of overripe-related compounds in non-Shiraz red grapes.

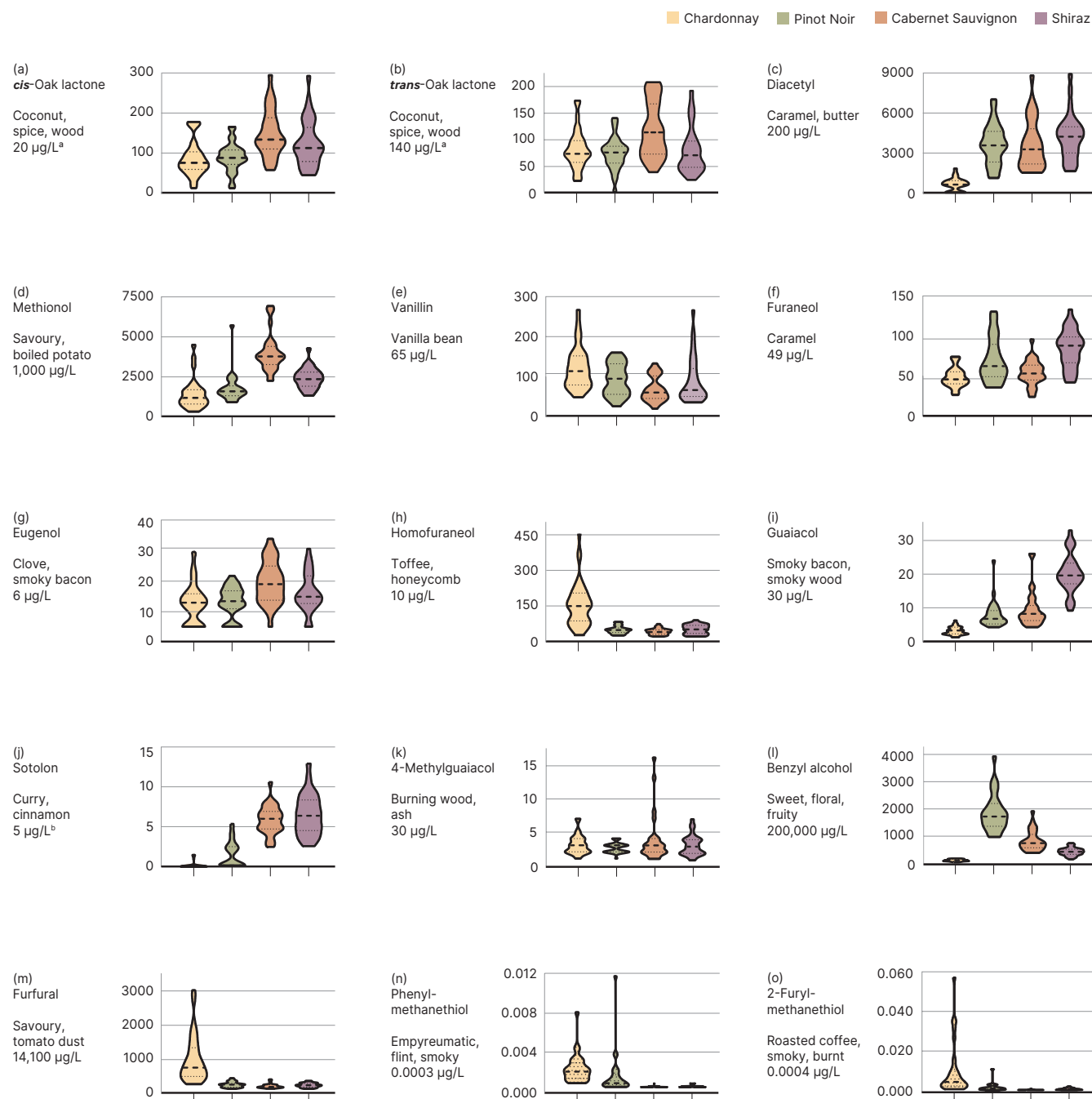
## Wine components and interactions influencing the in-mouth sensory properties of Australian wine

### Background

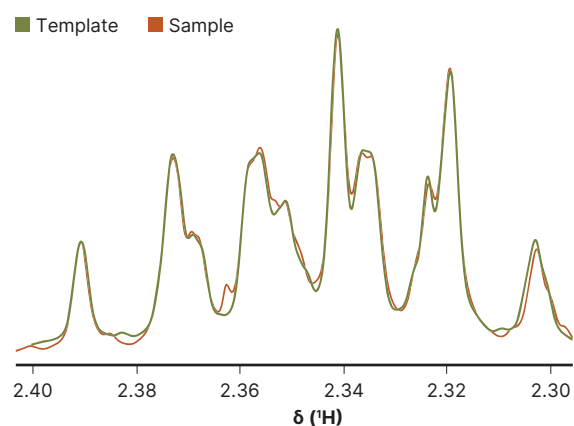
In conjunction with important volatile aroma compounds, non-volatile compounds strongly direct the in-mouth sensory experience of wine. Since individual compounds rarely function in isolation to confer a given attribute in beverages and foods, understanding how compounds interact is critical to unravelling the mechanism(s) of sensory perception. It is recognised that in-mouth sensory properties, such as the taste and texture of a wine, are multi-modal experiences. This project addresses fundamental questions regarding the compounds in wine that give rise to important in-mouth sensory properties, including tastes such as bitterness, savouriness and sweetness, as well as textural attributes such as astringency, viscosity and fullness. Recent work has found high concentrations of strong-tasting amino acids (e.g. proline) in Australian red wines from warm regions, which may add value to these products. Research will seek to understand how amino acids influence the in-mouth sensory properties of wine by interacting with other important taste-active wine components. The project will also aim to identify new target compounds, to understand their origin and impact in wine. Work will continue to elucidate how these compounds can be manipulated in the vineyard and winery, allowing producers to achieve distinct wine styles. For all aspects of the project, there will be a focus on understanding the extent that interactions between compounds (or classes of compounds) underpin sensory response. Longer-term outcomes will provide producers with strategies for the vineyard and winery to manage texture and taste outcomes in wine.

### Development and application of a rapid method for proline analysis in wine

The amino acid proline has recently been shown to contribute sweetness, fruit flavour and viscosity in red wines, prompting a survey of concentrations in Australian wines. To be able to rapidly and cheaply analyse proline in wine for this survey, an NMR method was further refined to improve speed, accuracy and precision. The improved method benefits from better spectral fitting, which allows for more accurate concentration prediction in low proline wines (< 1 g/L) (Figure 15). The calibration was also optimised to ensure accuracy across the range of wines analysed in the survey.



**Figure 14.** Results of a survey of thirty wines each of Chardonnay (pale yellow), Pinot Noir (green), Cabernet Sauvignon (tan), and Shiraz (purple) showing the concentrations (µg/L) of (a) *cis*-oak lactone, (b) *trans*-oak lactone, (c) diacetyl, (d) methionol, (e) vanillin, (f) furaneol, (g) eugenol, (h) homofuraneol, (i) guaiacol, (j) sotolon, (k) 4-methylguaiacol, (l) benzyl alcohol, (m) furfural, (n) phenylmethanethiol and (o) 2-furylmethanethiol. Aroma threshold determined in model wine except as noted: <sup>a</sup> white wine; <sup>b</sup> 10% v/v ethanol.



**Figure 15.** Improved spectral fitting, which has allowed for more accurate determination of proline concentration, especially at lower concentrations



The survey covered more than 950 Australian wines. Of the 529 samples quantified so far, variation among red vs white wines, as well as different cultivars, regions and styles has been notable (Figure 16). Fuller-bodied red wines such as Cabernet Sauvignon displayed higher mean proline levels (mean: 2.6 g/L, range: 1.2 g/L - 5.4 g/L) than lighter reds such as Grenache. Wines labelled Syrah exhibited lower proline concentrations with a narrower range than those labelled Shiraz. Among white wines, lighter-bodied Pinot Grigio wines had lower mean proline values (mean: 0.7 g/L, range: 0.5 g/L - 1.1 g/L) compared to fuller-bodied Chardonnay wines (mean: 1.3 g/L, range: 0.6 g/L - 2.4 g/L). Overall, the wide range of proline concentrations in Australian wines may contribute to the differentiation of red and white wines in terms of 'body' or 'fullness' and explain the fruit sweetness and smoothness of riper vintages, regions and climates.

#### Amino acid sensory thresholds

The influence of proline on wine sensory properties was investigated through taste detection and taste difference threshold tests. A model wine and two white and red wines were used for these experiments. The taste difference threshold of L-proline was determined in four styles, resulting in values of 7.4 g/L in Pinot Grigio, 5.9 g/L in Chardonnay, 6.1 g/L in a GSM blend and 5.0 g/L in Shiraz. Notably, the most sensitive assessors distinguished wines with less than a 0.7 g/L difference. Despite the high values obtained for sensory detection thresholds of L-proline in model wine (7.4 g/L) and the varieties mentioned above, it is essential to acknowledge that sensory threshold values do not inherently signify absolute potency, due to the difficulty of the sensory assessment method, which is prone to carry-over effects and assessor fatigue. Instead, these values enable a relative comparison of potency between different compounds. When compared to the available literature, the potency of proline is comparable to that of sucrose addition to wine.

The sensory detection threshold for glutamic acid in model wine was also determined to be 132 mg/L with a range of sensitivity from less than 5.5 mg/L up to or greater than 354 mg/L, highlighting the variability of human taste sensitivity.

#### Time-intensity analysis to determine the relative effect of proline and fructose on red wine taste and mouthfeel

Wine tasting is a temporal experience; that is, it occurs over a period of time. As such, the changing tastes, flavours and mouthfeel of a wine can be measured using a time-intensity sensory method. To explore the temporal influence of increased proline, a fruity Shiraz and a less-fruity Cabernet Sauvignon wine, both low in proline and residual sugar, were dosed with equi-sweet concentrations of proline or fructose, and compared.

Proline addition resulted in different perceptual responses when added to Shiraz or Cabernet Sauvignon wine, likely due to differences in wine style. In the Shiraz, both fructose and proline enhanced

overall fruit flavour intensity over time (Figure 17), while only added fructose increased perceived sweetness. Both proline and fructose suppressed the maximum intensity, duration and onset of bitter taste, as well as decreasing overall astringency and aftertaste. In the less-fruity and older Cabernet Sauvignon (data not shown), similar trends were found; however, the effects were smaller and both proline and fructose were perceived as increasing the overall sweetness, maximum intensity and duration of the wine.

### Addressing production challenges through the management of wine non-volatiles

#### Background

Non-volatile compounds, including phenolics, polysaccharides, proteins (macromolecules) and acids, form the bulk of the wine matrix after ethanol and water. They are critical to wine quality but can cause problems during wine production due to their larger size and propensity to aggregate. For producers, managing non-volatile composition begins in the vineyard, and extends right through to ensuring the shelf-life of bottled wine. There are a number of opportunities in the vineyard and winery to influence the outcomes of non-volatile compounds in wine, affecting their extraction, retention and conversion during winemaking. During wine production, there are points at which loss or instability of non-volatile compounds can occur, and it is critical that winemakers have strategies to predict and prevent these issues arising. This is best tackled by research to characterise the colloidal interactions and binding properties of macromolecules in wine, which remain poorly understood. With this knowledge, techniques and tools can be developed to manage non-volatile composition and interactions, such as fining agents or anti-fouling surfaces.

#### Drivers of red wine cold instability

Many of Australia's larger producers put their young red wines through a cold stabilisation process to ensure they are market-ready sooner. Red wines produced in the warmer regions of Australia can be affected by low titratable acidity and high pH, due to losses of malic acid and increased potassium, respectively. These wines may also have lower anthocyanin (colour) due to the accelerated degradation of grape pigments at higher vineyard temperatures. An imbalance in the ratio of potassium to tartaric acid can affect cold stability, leading to increased loss of tartaric acid as potassium bitartrate (KHT). Monomeric anthocyanin has been shown to have a protective effect on the cold-induced loss of KHT.

A comparative study was designed to investigate changes in cold instability in Shiraz ferments with different concentrations of grape anthocyanin. Two batches of Shiraz grapes, one with high anthocyanin and one with low anthocyanin, were sourced from the

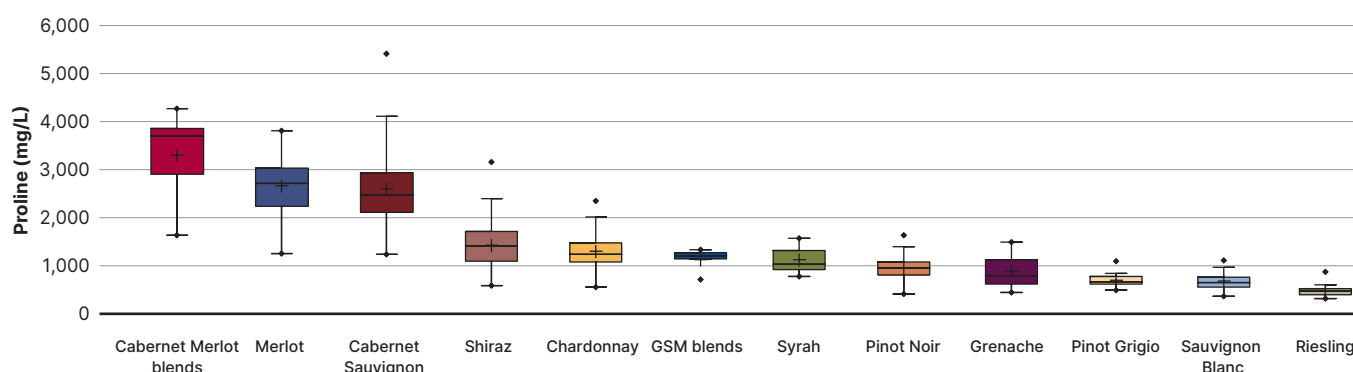
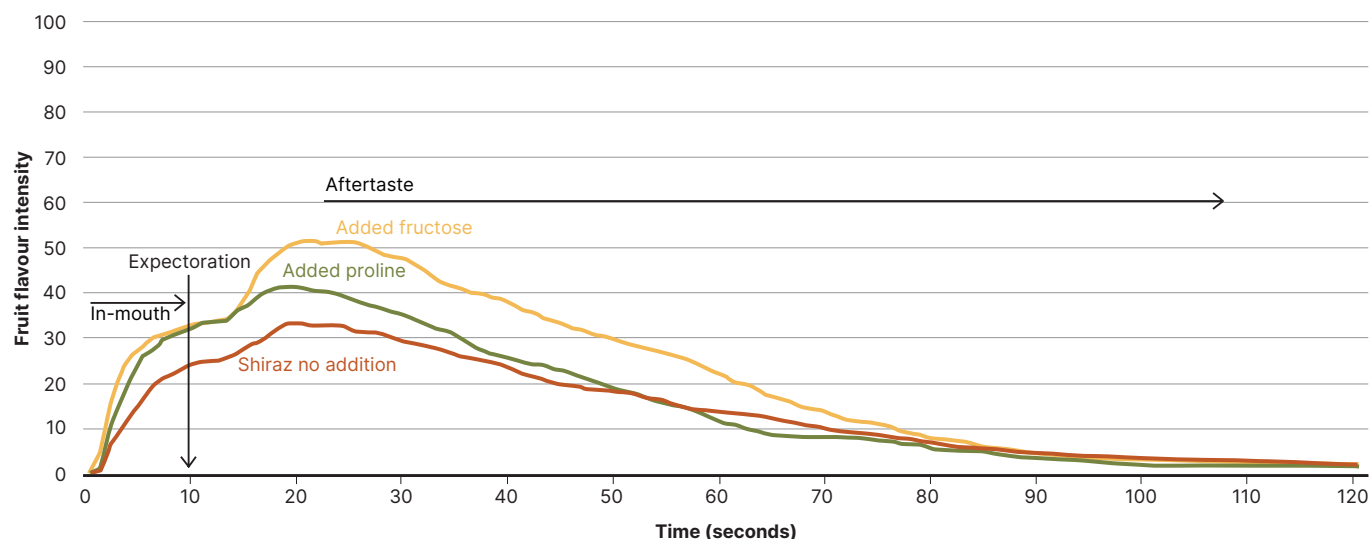


Figure 16. Results from a survey of proline concentration in Australian varietal and blended wines (n=529)



**Figure 17.** Average time-intensity rating of a Shiraz wine flavour intensity with and without added proline (2.75 g/L) or fructose (4 g/L)

Riverland, SA. The grapes were crushed and fermented according to a standard protocol, with anthocyanin concentration, polymeric pigment concentration and two measures of cold stability (change in conductivity/mini-contact test and unstable KHT crystal concentration during a three-day cold test) tracked over time (Figure 18).

Clear differences were evident in anthocyanin concentration between the two grape batches. Both reached a maximum between three and seven days of fermentation, and then decreased gradually (Figure 18a). This loss of anthocyanin occurred as polymeric pigment formed, albeit at very low concentrations (Figure 18b). Both sets of ferments received tartaric acid additions at the time of crushing, bringing the concentration up to approximately 6 g/L. During the first ten days of fermentation, both wines lost approximately 3 g/L of added tartaric acid, most likely due to KHT crystallisation, returning the concentration to the starting level of 3 g/L. Starting concentrations of potassium in musts were approximately 2 g/L and 1.5 g/L for the high- and low-anthocyanin wines, respectively, and this decreased to between 1.1 and 1.3 g/L within 10 days of fermentation, then stabilised. It was noteworthy that the wines reached an equivalent tartaric acid to potassium ratio within ten days.

As the wines lost tartaric acid and potassium, both sets of wines showed an abrupt decrease in cold instability, reaching apparent stability within ten days by the mini-contact test (Figure 18c). In terms of unstable KHT crystal formation during a standard three-day cold test (Figure 18d), the low-anthocyanin wine reached apparent stability rapidly within ten days of fermentation. The high-anthocyanin wine had a more gradual loss of cold-unstable KHT. It was interesting to note that the low-anthocyanin wine began to lose cold stability after 20 to 30 days (measured by the two cold instability tests), with this result being more marked according to the three-day cold test (Figure 18d). This decrease in cold stability occurred as the monomeric anthocyanin concentration dropped to below 200 mg/L in the low-anthocyanin wines, while in the high-anthocyanin wines, the concentration remained above 200 mg/L. The results showed there was some variability in the progression of cold stability during fermentation, and demonstrated differences in stability between wines with different anthocyanin profiles, despite having equivalent tartaric acid and potassium concentrations. The results also explain why some young red wines may initially be cold stable, and lose stability later on. The wines will continue to be monitored through ageing to explore changes in cold stability in relation to the ongoing loss and conversion of monomeric anthocyanins. This work aims to assist winemakers to assess the future cold stability of red wines based on the anthocyanin composition of young wines.

### Membrane fouling

The global market size for membranes used in the food and beverage processing industry is projected to increase by USD 2.14 billion between 2021 and 2025. Currently, food and beverage processing is the second-largest industrial market for membranes, where they are used in applications such as microfiltration, ultrafiltration, nanofiltration and reverse osmosis. The primary uses of these technologies are in the dairy industry, followed by beverage industries such as wine and beer. The remarkable success of membrane technology can be attributed to its gentle product treatment, high selectivity, compact design, and lower energy consumption than conventional separation technologies.

One significant drawback of membrane filtration is membrane fouling, which leads to reduced flow and, consequently, a decrease in process productivity over time. Analytical studies have shown the presence of irreversibly deposited proteins, polysaccharides and polyphenols on membranes, suggesting their involvement in fouling. Polysaccharides have been found to play a primary role in flow decline, while the impact of proteins and polyphenols largely depends on the specific membrane considered.

This project is seeking to understand the fouling process and to improve wine filtration through the development of non-fouling membranes. Process performance will be enhanced through the deposition of a plasma polymer coating on the membrane surface. To date the team has used a plasma coating with octadiene and acrylic acid to modify polyethersulfone (PES) and polyvinylidene fluoride (PVDF) membranes, aiming to alter their wetting properties and then investigate the effects when filtering wine. These modified membranes were applied in the ultrafiltration of unfined Sauvignon Blanc wine to investigate protein fouling. The coating of PVDF with acrylic acid, making it more hydrophilic, did not affect protein binding to the membrane surface. In contrast, modifying the PES membrane with octadiene, making it more hydrophobic, resulted in a 60% reduction in protein adsorption to the membrane surface. This suggests that the octadiene-coated PES surface exhibits resistance to protein fouling. The final outcomes of this study will guide the development of the next generation of low-fouling membranes, leading to cost reductions and improved productivity in the wine industry.

### Investigating interactions between proline and tannin

The study of wine-like adsorption events on defined surfaces provides insight into how different components interact in wine. This, in turn, supports the design of advanced materials with applications that affect wine quality, stability and shelf life. The technique of



*in situ* ellipsometry was used to study interactions between L-proline and purified grape seed tannin, compounds which can influence astringency and flavour complexity in wine. Preliminary results revealed that 1 g/L proline in model wine produced a surface thickness of 38 nm, while a combination of 1 g/L proline and 1 g/L tannin formed a single layer 108 nm thick, and 8 g/L proline and 1 g/L seed tannin showed a two-layer structure, one 70 nm and the second 318 nm. These observations suggest that when the ratio of proline to tannin is 1 to 1, these molecules interact without aggregation. However, as the ratio shifts to 8 to 1, molecular aggregates appear to form, presumably both on the surface and within the solution, resulting in a bilayer configuration where the second layer is significantly thicker. The exact mechanism driving this phenomenon is still under investigation. This work has demonstrated the effectiveness of this technique in probing the interactions between proline and tannin, with results contributing to understanding of their impact on astringency.

## Transformative microbiological inputs for innovative winemaking

### Background

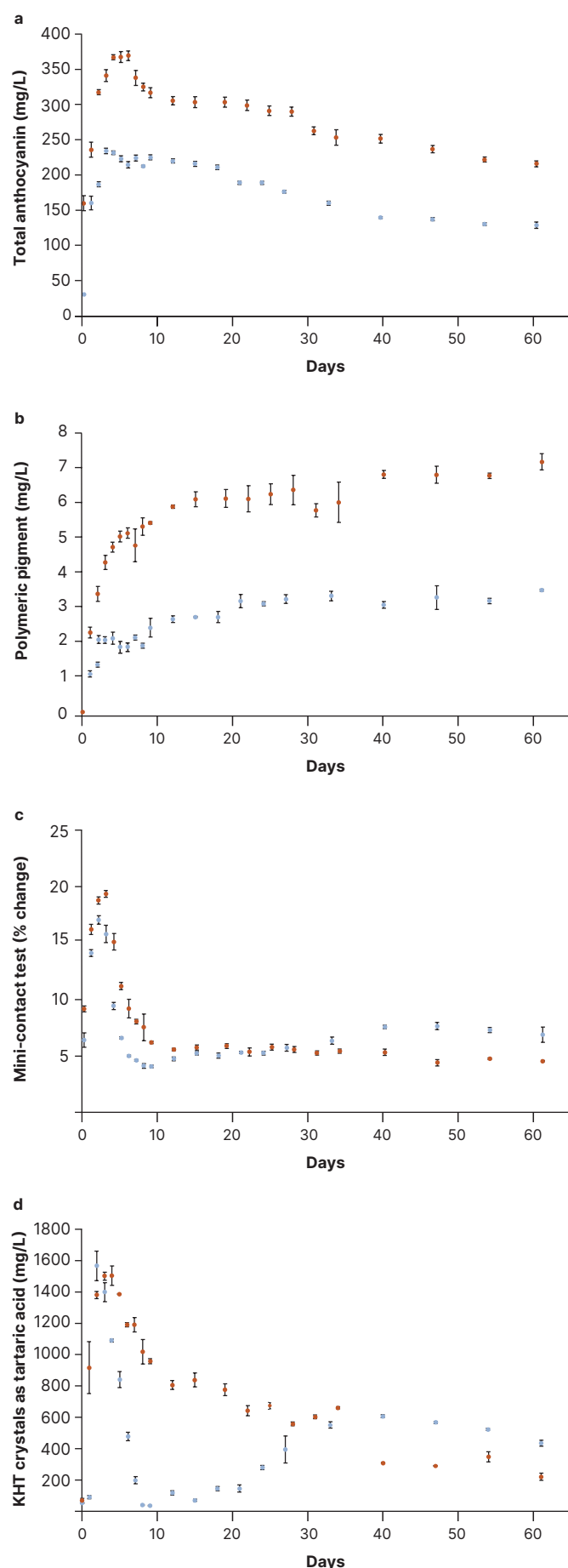
Classically, the development of yeast and bacterial strains for winemaking has revolved around selection, in which organisms with improved characteristics are specifically chosen for direct use or as breeding stock. As selection relies on genetic variation, mutagenesis is often used to increase the pool of differences available. However, standard mutagenesis/selection is a random process, in which isolates with the required alteration must be identified from a background of thousands of strains. Classical strain development is therefore resource-intensive, limiting the scope of research that can be undertaken.

Recent developments in the life sciences have seen the emergence of new technologies that enable precision genetic editing and engineering of plants, animals and microorganisms. The evolution of these technologies has been rapid, and innovation in this space is constant. While not occurring at the same pace as technical developments, changes to the regulatory landscape have still occurred, opening up opportunities for new ways to develop wine microorganisms. This project applies a range of cutting-edge genome editing technologies, such as CRISPR-Cas9, to provide transformative microbiological inputs for the wine industry. Harnessing these techniques will allow the rapid and efficient development of new microorganisms, through the use of accelerated breeding to assemble (stack) existing traits that do not frequently co-exist. These non-genetically modified (GM) strains could be directly deployed into the wine industry under a non-GM framework.

In addition, the project is exploring the metabolic diversity afforded by the application of revolutionary synthetic biology techniques to deliver microbial tools that will future-proof the Australian wine industry should regulatory and social licence barriers be removed. These synthetic biology-derived organisms can be endowed with entirely new traits, by introducing biochemical pathways from diverse sources to enable the production of novel, desirable compounds during fermentation.

### CRISPR editing in commercial wine yeast

CRISPR technology represents a significant advancement in genome editing, which, under specific conditions, can allow specific genome editing under a non-GM framework, potentially providing the means for accelerated strain development. A CRISPR framework was established for use in commercial wine yeast to facilitate engineering and combining multiple desirable traits into single 'trait-stacked' yeast strains. The CRISPR system has also been used to promote the introduction of novel biochemical pathways into commercial yeast strains to allow for the production of high amounts of desirable flavour and aroma compounds during fermentation.



**Figure 18.** Graphs of anthocyanin concentration (a), polymeric pigment concentration (b), change in conductivity/mini-contact test (c) and KHT crystal concentration during a three-day cold test (d) over time in low- (blue) and high- (orange) anthocyanin wines

## Fermentation management through optimal microbial consortia

### Background

Fermentation management in winemaking is complicated by a range of factors including the different types of fermentation employed (alcoholic and malolactic), the mode of those fermentations (concurrent or sequential, inoculated or not), the styles of wine being made, and the composition of the fermentation substrate (differences in solids, YAN or sugar). The specific strategy employed can shape fermentation outcomes and contribute to unpredictability in a fermentation's overall duration and completeness. This project studies the microbial interactions that support, or sometimes inhibit, efficient fermentation, seeking to identify microbial interactions that are maximally beneficial and minimally antagonistic. In addition, the project explores the recycling of fermentation end-products into nutritional supplements to support a robust ferment ecosystem. It is hoped that this aspect of the project can optimise process control while reducing reliance on external fermentation aids.

### Co-inoculation: how does SO<sub>2</sub> production by yeast affect malolactic fermentation?

Knowledge of yeast-bacteria strain compatibility and the amount of sulfur dioxide (SO<sub>2</sub>) a yeast strain produces are important considerations for successful malolactic fermentation (MLF). Sulfur dioxide accumulation during wine production is additive. The SO<sub>2</sub> produced by yeast will add to the SO<sub>2</sub> already present from additions made to grapes or must. Some yeast strains can produce substantial amounts of SO<sub>2</sub>, resulting in concentrations at mid-fermentation that are inhibitory to MLF. However, high yeast-derived SO<sub>2</sub> is not always inhibitory. The project team sought to understand the difference between MLF-inhibiting SO<sub>2</sub>-producing yeasts and MLF-complementary SO<sub>2</sub>-producing yeasts.

Bacterial survival in the presence of a specific SO<sub>2</sub>-producing yeast strain was correlated with an early, transient spike of acetaldehyde production. Survival of *O. oeni* coincided with molecular SO<sub>2</sub> concentrations remaining below an extremely low inhibition threshold, which increased exponentially in ferments by some yeast strains in the first three days of co-fermentation. Strain-dependent sensitivity of *O. oeni* to bound SO<sub>2</sub> remains a possibility, although the extent and mechanism of such inhibition by the SO<sub>2</sub> adduct during co-fermentation remain unclear. Results showed that the effects of low, equilibrium concentrations of molecular SO<sub>2</sub> should also be considered in conjunction with total SO<sub>2</sub> as a measure of SO<sub>2</sub> toxicity towards *O. oeni* following co-inoculation.

Co-inoculation of *O. oeni* with high SO<sub>2</sub>-producing *Saccharomyces cerevisiae* strains was also associated with elevated diacetyl concentrations in finished wines. The wines with high diacetyl concentrations were found to be distinct by a sensory panel, with comparatively high citation frequency for a 'buttery' sensory attribute. The SO<sub>2</sub> and acetaldehyde production capacity of yeasts are, therefore, meaningful co-inoculation selection criteria.

### Can relieving one stress exacerbate others? It can if you are a yeast.

Sulfur dioxide added during picking or crushing of grapes can lead to elevated concentrations in freshly prepared juice. Most wine yeast strains can tolerate SO<sub>2</sub> because of a membrane protein called Ssu1p that can pump excess SO<sub>2</sub> out of the cell. Some wine yeasts constantly produce Ssu1p and do so in far greater amounts than others. The constant over-expression of the gene responsible (*SSU1*) makes them more able to resist the stress associated with inoculation into juices that already contain a lot of SO<sub>2</sub>. High SO<sub>2</sub> tolerance in wine yeast is a feature that is generally perceived as positive. However, previous work identified a negative association between SO<sub>2</sub> tolerance and copper tolerance in *Saccharomyces cerevisiae* wine yeasts, meaning that many SO<sub>2</sub>-tolerant wine yeasts tended to be sensitive to elevated copper concentrations. Elevated copper concentrations can occur in grape juice due to the use of copper-based sprays in vineyards.

The project team sought to understand the inverse correlation between SO<sub>2</sub> tolerance and copper tolerance. It was shown that overexpression of the *SSU1* gene, normally associated with SO<sub>2</sub> tolerance, induced copper sensitivity in an otherwise copper-tolerant strain, demonstrating a causal relationship. Transcriptional and proteomic analysis revealed that *SSU1* overexpression did not suppress the expression of the gene necessary for copper tolerance (*CUP1*) or constrain the production of the Cup1p protein. This work provided evidence that *SSU1* overexpression induced sulfur limitation during exposure to copper. The team concluded that copper and SO<sub>2</sub> tolerance are conditional traits in *S. cerevisiae*, providing evidence of the metabolic basis for their mutual exclusivity. The findings suggested that the evolution of SO<sub>2</sub> tolerance could have played a role in driving the extreme amplification of the *CUP1* copper tolerance gene observed in some yeasts. It also suggests that selection for moderate SO<sub>2</sub> tolerance might be a preferred strategy for breeding yeast strains with broad stress tolerance traits.

## Co-innovation design process: No- and low-alcohol wine production

### Background

No- and low-alcohol (NOLO) beverages have shown immense growth as a category in recent times, both domestically and globally, with health and well-being initiatives driving interest. NOLO wines have more recently lagged behind the growth of the NOLO beer and spirit categories, due to perceived quality issues with the products, based on their lack of semblance to traditional wines. This NOLO co-innovation design project was undertaken by the AWRI with Wine Australia and industry partners to identify and design new NOLO initiatives with the potential to generate immediate impact for the wine sector. The overall goal is to help NOLO wine producers to bridge the quality gap between traditional wines and current NOLO offerings.

### Industry engagement

More than 30 interviews were conducted with wine industry professionals from all segments of the industry, to better understand the gaps in research and the 'pain points' of producers, suppliers and retailers of NOLO products. By better understanding the problems faced by industry, research initiatives can be tailored to provide effective outcomes for levy payers.

### Identifying priorities and pain points

After completing the industry interviews, project team members participated in a workshop led by Impact Innovation Group. This workshop was designed to distill the raw industry consultation information that been collected by project team members into simple statements, meant to summarise the pain points and priorities of industry stakeholders. Some of the glaring issues with the NOLO category were identified as a lack of aroma, flavour and mouthfeel caused by the process of removing alcohol from a wine, which also removes a large portion of the compounds responsible for aroma and flavour. These losses can leave NOLO wines as poor representations of traditional wines.

### Developing project proposals after engaging with the sector

After the extensive industry consultation and prioritisation steps, initiatives focusing on the following aspects were proposed to Wine Australia, in order to best serve the needs of NOLO producers:

- Mouthfeel\* – increasing the mouthfeel and textural components of NOLO to better resemble that of their traditional counterparts.
- Flavour stability\* – increasing aroma and flavour in NOLO wines through various processes, from grapegrowing techniques through to fermentation, post-dealcoholisation, and maintaining aroma and flavour post-packaging.
- Pre-bottling stability\* – giving NOLO producers more time between dealcoholisation and packaging in which to focus on product development.



- NOLO knowledge hub – an online resource for all aspects of NOLO wine production. This resource would be designed for producers who are interested in making NOLO products but do not know where to start.
- Spinning cone column scale-up – a scale-up program to help producers have confidence that NOLO products developed on the pilot-scale spinning cone column can be successfully transferred to commercial volumes.
- Lower alcohol/mid-strength wine – understanding and developing techniques to increase quality of wines between 4.5% and 10.0% alcohol.

All six of these initiatives were reviewed by Australian Grape & Wine's Research Advisory Committee. Based on that review, as well as prioritisation from Wine Australia, the first three proposals (marked with an asterisk) were progressed to Initiative Stage Investment Applications for consideration by Wine Australia.

## Co-innovation design process: Wine production and quality

### Background

A co-innovation and co-design process with the grape and wine sector and other research and commercial partners was used to design business and investment plans for innovation under the theme 'Wine production and quality'. The first step was to identify sector and market needs, opportunities and pain points before any solutions were designed. Based on these findings, proposals to deliver these potential solutions or innovations were developed with feedback from Wine Australia. In conjunction with the development of proposals, co-investment and co-design were sought from commercial partners identified during the consultation process.

### A spotlight on wine production and quality pain points

For the first phase of the co-design process, Wine Australia identified six key topics as being relevant to the wine sector for further consultation: 'reductive' characters, smoke taint, non-*Saccharomyces* yeast, heat and cold instability, aeration of ferments and *Brettanomyces* spoilage. AWRI staff attended two workshops facilitated by Impact Innovation Group, to develop skills and access new tools for undertaking co-design interviews with stakeholders. At the outset, the themes defined were considered more mature as industry challenges, and therefore rather than characterising each challenge, the focus of the first workshop was to validate each challenge and to conduct a gap analysis. Facilitated activities and tools were used, including an assessment of unique value chains for each project challenge, development of value proposition and business model canvases, and building preliminary proposals. During the consultation phase, AWRI project team members completed at least 200 interviews with small, medium and large wine producers and, where applicable, grapegrowers, domestic and international suppliers and members of the wine trade, as well as other participants along the supply chain. These interviews tested key assumptions within each challenge and identified relevant pain points.

### Framing solutions

The insights and co-design inputs from the sector were subsequently developed into impact statements and frequently asked questions (ISFAQs), which aimed to highlight industry priorities and indicate how the potential impact of a commercial solution might be realised, if supported by research and innovation. Fourteen ISFAQs were submitted to Wine Australia for review. The key challenge and potential solution(s) identified for each are outlined below:

- Smart surfaces\* – developing a fining agent that successfully removes 'reductive' aromas during all stages of the winemaking process without affecting varietal and stylistic aromas or palate weight.

- Nitrogen sensor – developing a rapid YAN test that can be used in a simple and cost-effective way to assist winemakers to rapidly respond to fermentation challenges that may lead to 'reductive' aromas.
- 'Reductive' Shiraz ferments – understanding why certain varieties, such as Shiraz, present more 'reductive' faults than others, and develop yeast strains or specific remediation tools for such varieties.
- Smoke rapid test\* – developing a rapid test for grapes to classify broad categories of 'clean', 'clearly smoke-exposed' and 'further testing required', enabling quicker grape streaming and a smaller sample load for detailed testing.
- Assessing smoke-affected grapes – validating and refining the decision tool based on recent research to deliver practical decision support for growers and winemakers assessing smoke-exposed fruit.
- Linking composition of grapes with smoky flavours in wine – developing better remediation options to recover value from smoke-affected red grapes, such as new activated carbon products or enzymes.
- Non-*Saccharomyces* yeast – developing non-*Saccharomyces* yeast that replicate the aroma complexity and palate structure of wild-fermented wines, retaining the convenience and reliability of inoculated fermentations.
- Single step stabilisation\* – developing a dual heat- and cold-stabilisation step that could be performed in a single tank, addressing both the need for a bentonite alternative and reducing energy inputs.
- Ultrafiltration – supporting a commercial pathway for the adoption of ultrafiltration as a replacement for both bentonite and PVPP fining agents in white winemaking.
- Protein sensor – developing a rapid, deployable protein sensor and validating it against a new heat test to reduce bentonite requirements.
- Modular equipment for aeration\* – defining the limitations of existing aeration equipment and developing or augmenting existing equipment to simplify procurement for small to medium-sized enterprises.
- *Brettanomyces* diagnostics\* – developing fast, scalable and affordable early detection tools for *Brettanomyces* using DNA-based techniques.
- *Brettanomyces* control – developing new biological tools to help control *Brettanomyces* growth and reduce wine spoilage, making it easier for winemakers to protect their premium red wines.
- *Brettanomyces* remediation – developing new biological tools that specifically target spoilage compounds produced by *Brettanomyces* and therefore can 'clean' affected wines.
- Volatile acidity spoilage – developing biocontrol microorganisms that naturally inhibit the growth of spoilage microorganisms responsible for volatile acidity, decreasing the incidence and impact of wine spoilage.

Of these initiatives, a subset of five (marked with an asterisk above) were selected by Wine Australia for review by Australian Grape & Wine's Research Advisory Committee. Based on the outcome of the review process, these five were developed into Initiative Stage Investment Applications for Wine Australia, describing the business and investment plans to deliver these potential solutions.

## Environment, sustainability and natural capital

*The success of the Australian grape and wine industry is strongly tied to its long-term custodianship of the natural environment. Soil, water, biodiversity and climate all contribute to the success or failure of grapegrowing across Australia. Electricity, fuel, refrigeration and waste disposal are all major costs in winemaking. Projects under this theme aim to assist producers to improve environmental, social and economic performance; to adapt to the challenges of a variable climate; to make the most of the grapevine clonal resources available; to develop tools to verify the origin of Australian wines; and to improve management of pests and diseases.*

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### Staff

Sheridan Barter, Dr Marlice Bekker, Dr Jenny Bellon, Eleanor Bilogrevic, Dr Anthony Borneman, Danielle Carter, Adrian Coulter, Robyn Dixon, Damian Espinase Nandorfy, Marcel Essling, Dr Toni Garcia Cordente, Laura Hale, Alexander Hargrave, Prof. Markus Herderich, Wen-Hsiang (Denny) Hsieh, WenWen Jiang, Dr Deanna Langone, Dr Mardi Longbottom, Anne Lord, Dr Agnieszka Mierczynska-Vasilev, Dr Simon Nordestgaard, Dr Cristobal Onetto, Dr Mango Parker, Liz Pitcher, Dr Simon Schmidt, Alex Schulkin, Steven Van Den Heuvel, Dr Cristian Varela, Dr Chris Ward, Dr Eric Wilkes.

### Students

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### Collaborators

AME (Cam Clifford); ARM Nursery (Steve Partridge); Australian Grape & Wine (Tony Battaglione, Anna Hooper, Lee McLean); Brown Family Wine Group (Brett McClen); Chalmers Wines (Kim Chalmers); CNH (Peter Thompson); CSIRO (Paul Boss, Arryn Clarke); Food Agility Cooperative Research Centre (Michael Schaefer); Freshcare Ltd (Fiona Grime, Jane Siebum, Angela Steain); G&J East/Clemens (Zac Edwards, Phillip Rice); GOtrack (Marcin Lis); Howard Park Wines (David Botting); Impact Innovation Group (Angus Crossan, Brian Ruddle); KPMG (Jacqui Payne, Matthew Nevison); Pernod Ricard Winemakers (Shaun McBeath, Tim McCarthy); SARDI (Dr Ismail Ismail, Assoc. Prof. Paul Petrie, Dr Mark Sosnowski); schools across Australia; South Australian Vine Improvement Association (Chris Bennett); Sustainability Advisory Committee (Chris Dent, Philip Deverell, John Ide, Madeline Jarrett, Jennifer Lynch, Cath Oates, Michael Parks, Kyra Reznikov, Dr Richard Smart, Lachie Thomas); Treasury Wine Estates (Ben Harris); University of Adelaide (Assoc. Prof. Rini Akmeiliawati, Dr Lei Chen); Western Australian Vine Improvement Association (Richard Fennessy); Wine Australia (Martin Cole, Drea Hall, Jay Jayeshawaran, Alex Sas, Rachel Triggs, Liz Waters); Yalumba Nursery (Bethany Collins, Ballie Trenwith).

## Supporting the sustainability of grape and wine businesses and Australia's sustainability credentials

### Background

Launched in 2019, Sustainable Winegrowing Australia is Australia's national program for grapegrowers and winemakers to demonstrate and continuously improve their sustainability in the vineyard and winery. The program takes a holistic approach to managing, supporting and promoting sustainability and covers environmental, social and economic aspects of grape and wine production. In 2020, Australian Grape & Wine, the AWRI and Wine Australia signed a memorandum of understanding outlining the collaborative arrangements for governance and delivery of Sustainable Winegrowing Australia. Sustainable Winegrowing Australia is governed by a joint steering committee with representatives from the three organisations, with their respective roles outline below:

- Australian Grape & Wine provides oversight and guidance to the program, liaises with the Australian Government and state governments, and consults with the sector's key stakeholders on policy and development.

- The AWRI provides program management, membership administration, technical development, and extension and adoption activities.
- Wine Australia provides marketing and communications to help attract and retain members and to promote Australia's sustainability credentials to key stakeholder groups globally.

### Membership and trust mark

Membership of Sustainable Winegrowing Australia grew to 1,227 in 2022/23, a 32% increase from the previous year. The membership represents 45% of Australia's vineyard area and 52% of the national crush. There was also a significant increase in the proportion of members achieving certified status, growing from 24% in 2021/22 to 52% in 2022/23. Almost 30% of Australia's wine-grape vineyard area is now covered by Sustainable Winegrowing Australia certification. With the growth in certification, adoption of the trust mark has also increased, with close to 700 trust mark licence applications received from members during the year.

### Industry engagement

During the year the Sustainable Winegrowing Australia team delivered certification training to 460 participants across 44 regions. These sessions were supplemented by online workshops and follow-up support for members seeking certification. The team also responded to 3,282 sustainability-related enquiries, on topics including general information about the program, new memberships, data and technical support for certification.

The project team continued to deliver monthly online regional forums, which have provided a strong feedback mechanism to address regional issues and deliver news and updates directly to the regions. The team also continued to work with several regions to aggregate and deidentify their members' data to help the regions highlight improved performance and identify areas for future investment and support.

For the second time, highlights from Sustainable Winegrowing Australia member data were published in an Impact Report for the program. Member data was also included in a number of presentations and used to develop an updated life cycle analysis for Australian wine and to inform the baseline greenhouse gas emissions in the Wine Australia Emissions Reduction Roadmap.

## Co-innovation design process: Sustainability

### Background

This project sought to identify opportunities and pain points in sustainable grape and wine production to design business and investment plans for innovation through a co-innovation and co-design process with the grape and wine sector and other research and commercial partners.

### Industry engagement

The rapidly changing global legal and regulatory environment relating to environmental, social and governance (ESG) presents significant challenges for the Australian grape and wine sector. In response, Wine Australia initiated the development of an ESG strategy for the Australian grape and wine sector, engaging KPMG to assist in the plan's development. AWRI was engaged to develop plans to address the research, development and adoption workstreams in parallel





with the broader ESG strategy for the sector. A co-innovation and co-design process with grape and wine producers and other research and commercial partners was undertaken to design business and investment plans for innovation.

As a first step, sector and market needs, opportunities and pain points in sustainable grape and wine production were identified through a series of workshops facilitated by KPMG. Representatives from AWRI and Wine Australia joined grape and wine stakeholders to identify key priority areas for research, development, adoption and innovation initiatives to help define and implement best-practice ESG. Circularity, sustainable inputs and evidence-based metrics were identified as priority areas. These priority areas were validated and further explored in additional consultations conducted by AWRI staff. In addition, the AWRI identified potential solution providers and collaborators, both domestically and internationally, with proven track records in the priority areas. During this second phase the AWRI consultation delved deeper into specific project initiatives to identify knowledge gaps and researchable questions that, when addressed, will support the sector in achieving its sustainability goals.

### Identifying priorities and pain points

Comments, insights and definitions of the challenges being faced were gathered from more than 40 stakeholder interviews with small, medium and large wine producers and grapegrowers; domestic and international suppliers; and members of the wine trade; as well as those involved in other steps along the supply chain. These interviews tested key assumptions within each priority area and identified relevant pain points. Emphasis was placed on gaps in the existing research, development and extension activities within Australia, and opportunities to adapt international research to accelerate progress.

Briefly, sentiments were unanimous in highlighting the critical need to strengthen sustainable practices for pest and disease management. Solutions are required for biological control of insect pests and for mildew control, and to decrease copper and sulfur sprays in the vineyard. Producers expressed great concerns about weed control without herbicides. Although it is clear that this is a major topic that spans all agricultural sectors, it was recognised that the wine sector should explore initiatives that address restrictions and resistance to glyphosate use through the implementation of sustainable viticultural practices and innovative AgTech solutions. Soil health and carbon sequestration were key interests, from a circularity perspective, and due to a lack of consistent, globally recognised, evidence-based metrics.

Circularity in winery energy use and the reuse of winery wastewater were highlighted in the majority of the consultation conversations. Key interests included the use of green energy, providing alternative winery processing methods to decrease the energy associated with cooling and stabilising wine, and providing better recycling processes to eliminate salts and other contaminants from winery wastewater to repurpose it as irrigation water for vineyards. Waste reduction is another area of great concern for the sector, with many producers expressing concern about how and when they might be able to achieve the sustainability targets to which they have committed. Initiatives for eliminating single-use plastics were also identified as a critical need. Finally, the largely untapped potential for generating value from waste was emphasised, with a focus on generating value

from excess grapes and wine, as well as using grape marc and other viticultural waste materials to generate value-added products. A clear need for investment in research, development and extension to support the sector and underpin the sector's ESG credentials was identified.

### Developing initiatives after engaging with the sector

A total of 15 initiatives were identified and prioritised out of 40 initial proposals, aligning with the themes of sustainable inputs, circularity and evidence-based metrics. Impact statements and frequently asked questions (ISFAQs) were developed with the guidance of Impact Innovation Group and shared with Wine Australia. These initiatives are listed below:

- Capturing and generating value from fermentation CO<sub>2</sub>\*
- Generating value from waste\*
- Waste streams and fungi\*
- Winery wastewater recycling\*
- Assessment of non-sustainable winery additives
- Compost teas
- Mildew control 2.0\*
- Biocontrol for insect pests\*
- Copper remediation of vineyard soils
- Using wine to store green energy
- Measuring the impacts of native insectary plants
- Making red wine from smoked grapes
- Reducing herbicide use in the vineyard
- Vineyard longevity
- Vineyard soils

Six of these initiatives (marked with an asterisk above) were selected by Wine Australia to be shared with Australian Grape & Wine's Research Advisory Committee. Of these, only one (Capturing and generating value from fermentation CO<sub>2</sub>) was selected for further development into an Initiative Stage Investment Application.

## Genetic diversity of Australian wine grapevine germplasm

### Background

Grapevine planting material represents a major investment and critical production asset for the Australian wine industry, but the genetic diversity that is present in Australia is poorly understood. While grapevine cultivars can be typed by ampelography and/or genetic tests, clonal identification solely relies on the tracing of supply records to the point of origin. Such records are not always available or reliable, particularly for older accessions. Whole-genome sequencing provides the most highly detailed methodology for defining grapevine cultivars and more importantly, clones of those cultivars.

The AWRI has developed a world-first clonal sequencing methodology that combines the latest next-generation genome sequencing technologies, high-performance computing and customised bioinformatics tools. This technique has been successfully used to define a subset of clonal variation in Chardonnay, while providing historical insights into the origins of the Gingin clone. It has also been used to investigate sequence-verified sources of clonal material for replanting efforts. This technology is now being used to assemble a foundational database containing hundreds of grapevine clonal genomes that will be able to robustly identify the majority of grapevine varieties and clones of economic importance within Australia.

### A Shiraz reference genome

Shiraz is the most planted wine-grape cultivar in Australia and the fourth most planted worldwide. Given the importance of Shiraz for Australian wine production, a reference genome was produced for this cultivar. The Shiraz genome provided a detailed view of the genetics that underpin this cultivar, including the discovery of a specific combination of genetic variants within the terpene

synthase gene *VviTPS24*, which, when combined with appropriate environmental triggers, may allow Shiraz to produce high levels of rotundone, the aroma compound responsible for the distinctive 'peppery' characteristics of some cool climate Shiraz wines.

Genome sequencing data of Australian grapevine germplasm was analysed for more than 800 grapevine samples across 23 varieties. This represents the majority of clones from the main suppliers of grapevine germplasm in Australia. Clustering of samples using unique DNA fingerprints produced detailed maps of clonal-specific DNA variation that can be used to identify specific clones within each cultivar.

## Citizen science – Yeast catchers

### Background

Yeasts and other fungi are vital to industries including baking, brewing, pharmaceuticals and biofuels. Despite their utility, the diversity of yeasts in Australia is still largely untapped. New species and strains can create opportunities for future agricultural and food production and the transition to a bio-based economy.

The AWRI is working with school students around Australia on a citizen science project called 'Yeast catchers' that is looking for undiscovered Australian fungal species. This project is funded by a Citizen Science grant from the Australian Government Department of Industry Science and Resources, as part of a program that seeks to engage the public in scientific research projects. The project aims to isolate yeasts endemic to Australia, while introducing real-world scientific research into Australian schools.

### A cornucopia of Australian yeasts

A combination of face-to-face workshops with presentations and practical exercises and online video-based conferencing have been used to connect with more than 2,000 student scientists who have participated in the 'Yeast catchers' program. This has encompassed more than 50 schools from SA, WA, Queensland, NSW, Tasmania and the ACT.

After schools were provided with more than 3,000 sample tubes, students attempted to capture natural yeasts by adding environmental samples (e.g. flowers, gumnuts, soil) to a selective growth media. More than 6,000 individual yeast isolates obtained from over 750 positive samples were assessed to determine their species using DNA-based microbial profiling techniques. At least 89 species of yeast were then identified across 32 genera. Initial literature reviews suggest that many of these species have not previously been isolated from Australia and will provide insights into the global distribution and genetic variation of these species. Furthermore, based on the ITS profiling data, there is potential for an additional 183 of these isolates to represent an estimated 32 novel yeast species, with whole-genome sequencing in progress to support these findings.

## Understanding the basis of agrochemical resistance in biotrophic grapevine pathogens

### Background

The development of resistance to agrochemicals is an ever-increasing problem in agriculture, including in viticulture. Results of recent SARDI/AWRI research projects have shown that there is widespread prevalence of known resistance alleles to many of the commonly used agrochemicals in the main biotrophic grapevine pathogens *Erysiphe necator* (powdery mildew) and *Plasmopara viticola* (downy mildew). This project is extending collaborative work with SARDI beyond mapping individual resistance alleles, using whole-genome sequencing to simultaneously assess all known resistant loci, in addition to providing population data regarding the evolution of these traits in the field.

### DNA sequencing for agrochemical resistance diagnostics

Resistance to DMI (group 3) and QoI (group 11) fungicides can occur through a combination of different types of mutations. In addition to single nucleotide changes in the sequence of specific target genes (*cyp51* for DMIs, *cytB* for QoIs), changes in gene copy number can also influence levels of fungicide resistance. In collaboration with SARDI, the AWRI has provided sequence-based diagnostics for evaluating the prevalence of resistance mutations in powdery and downy mildew. A combination of amplicon-based targeted sequencing and whole-genome sequencing has been used.

## Autonomous machinery to replace herbicide for undervine weed control

### Background

There is increasing interest in non-chemical management of undervine weeds in Australian vineyards. However, common alternatives, such as cultivation and mowing, require more and slower tractor passes. Autonomous vehicles – either retrofitted existing tractors or new autonomous robots – are one solution to manage the extra work required. The performance of these vehicles in Australian vineyards was investigated in this project, funded by the Australian Government's Established Pest Animals and Weeds Management Pipeline Program.

### Autonomy kit for tractor

The GTrack autonomy kit fitted to a tractor last year continued to be tested on increasingly long runs. Routes around 50 km performing mid-row slashing were completed successfully. Sensors were installed on implements to investigate automatic detection of issues such as hydraulic oil leaks. A new camera system that detects people and other objects was also installed and this was a major improvement over the LIDAR used previously, which had caused false stops when operating in long grass and with big canopies.

### Autonomous weeding robot

A SITIA Trektor robot was also trialled for undervine weeding. The system was extremely temperamental and experience with this vehicle emphasised just how robust vehicles from established tractor manufacturers are by comparison. Making an existing vehicle autonomous is likely less complex than building a robust vineyard vehicle.

### Autonomous lawnmowers

Husqvarna Automowers were also trialled for vineyard floor management. While working well on lawns, these vehicles were found to not be suitable for operation in vineyards. Vehicle ground clearance was insufficient and the mowers were prone to blockage caused by canes. Traversing large numbers of obstacles (posts and vines) also meant that the machine was constantly stopping and turning, greatly reducing the area it could cover. It struggled to cover more than a few rows. On a normal lawn each Automower might be able to cover around 0.5 ha, but in a vineyard it might only be able to cover 0.1-0.2 ha.

### Future directions

This was the final year for this project. Overall, it has demonstrated that tractor retrofit-kit systems such as that from GTrack can be used to autonomously perform operations including slashing, cultivation and spraying. The focus of the work to date has been on undervine operations, but given the opportunity, it would be beneficial to perform more work with the GTrack system and other autonomous systems on other applications in Australian vineyards. In particular it would be advantageous to complete more work on canopy fungicide spraying, since this is responsible for the largest number of tractor passes in most Australian vineyards. During the course of the project, manufacturers made some major advances in obstacle detection systems, but more work is still needed on implement feedback. Testing out the ability of autonomous systems to work in regional areas without phone coverage and developing solutions for mapping of vineyards using drones to allow adoption of autonomy at scale would also be beneficial.



## Foundational data and support services

*The research, development and extension activities of the AWRI are underpinned by an efficient service capacity that provides and supports infrastructure; delivers research support and analytical services; manages governance, legal and financial affairs, information technology and workplace safety; generates foundational data sets; and monitors trends in Australian wine composition and production practices.*

### Staff

Caroline Bartel, Sheridan Barter, Ida Batiancila, Laura Bey (to 8 July 2022), Eleanor Bilogrevic, Catherine Borneman, Natalie Burgan, Danielle Carter, Cerys Colquhoun, Susanne Copeland, Alfons Cuijvers, Georgia Davidson, Chris Day (to 12 May 2023), Russell Desmond, Dr Zung Do, Shiralee Dodd, Damian Espinase Nandorfy, Angus Forgan, Assoc. Prof. Leigh Francis, Josephine Giorgio-Ion, John Gledhill, Robyn Gleeson, Jesse Hall, Kate Hardy, Alex Hennig, Thomas Hensel, Prof. Markus Herderich, Kieran Hirlam, Dr Josh Hixson, Adam Holland, Leanne Hoxey, Wen-Hsiang (Denny) Hsieh, Dr Vilma Hysenaj, WenWen Jiang, Pauline Jorgensen, Dr Mark Krstic, Jillian Lee, Joshua Lennon, Desirée Likos, Susan Lincoln (from 25 January 2023), Dr Natoiya Lloyd, Simone Madaras, Jacinta McAskill, Rhiannon Mensforth (from 19 September 2022 to 10 May 2023), Emily Milsom, Emma Muehlberg, Bryan Newell, Peter Nguyen (from 26 June 2023), Dr Luca Nicolotti, Dr Simon Nordestgaard, Jennifer O'Mahony, Dr Wes Pearson, Lisa Pisaniello, Dr Amy Rinaldo (to 24 March 2023), Ella Robinson, Dr Tony Robinson, Kyla Schmidt, Marco Schoeman, Jessica Schrapel, Neil Scrimgeour, Gina Sellars, Dr Tracey Siebert, Con Simos, Dean Smiley, Mark Solomon, Pamela Solomon, Dr Yihe (Eva) Sui, Fang Tang, Dr Maryam Taraji, Don Teng, Heather Tosen, Flynn Watson, Kylee Watson, Dr Rachel West, Dr Matthew Wheal, Dr Eric Wilkes, Dr Patricia Williamson, Paul Witt (to 21 December 2022), Qi Wu, Sara Zhan.

### Collaborators

AB Biotek (Dr Tony Balzan, Dr Caleb Cheung, Dr Anthony Heinrich, Alex Moriarty, Dr Tina Tran, Pierre Van Rensburg); Archie Rose Distillery (Dave Withers); Australian Institute for Bioengineering and Nanotechnology, University of Queensland (Dr Esteban Marcellin Saldana); Australian Vintage Limited (Tom Dusseldorp, Emily Harper, Jamie Saint); Campden BRI (Peter Headridge); Chr. Hansen (Duncan Hamm, Amanda Tanga); Compusense, Canada (Ryan Corrick); Drinkwise (Simon Strahan); ETS Laboratories (Gordon Burns, Eric Herve); FlavourTech (Paul Ahn, Leon Skaliotis); Lallemand (Jason Amos, Dr Eveline Bartowsky); Lanxess (Dr Jens Bitzer); Mass Spectrometry and Proteomics Facility, University of South Australia (Prof. Peter Hoffmann); PIRSA (Prof. Peter Appleford, Bodhi Edwards); SARDI (Dr Marcos Bonada, Dr Gaston Sepulveda); South Australian Genomics Facility (Prof. David Lynn); Tarac Technologies (Jeremy Blanks, Greg Jackson); Treasury Wine Estates (Marie Clay, Ben Harris, Iain Jones, Dr Catherine Kidman, Kym Schroeter, Dr Alison Soden); University of Adelaide (Assoc. Prof. Paul Grbin); University of Melbourne (Prof. Malcolm McConville); University of Western Australia (Assoc. Prof. Michael Clarke); VA Filtration/Memstar (Matthew Hooper, Nigel Sneyd); Wine Australia (Dave Gerner); Wine Industry Technical Advisory Committee (Iain Jones); Yalumba Family Winemakers (Louisa Rose).

## Efficient administration

### Background

The AWRI's management and administration is carried out by a dedicated team of specialists who work together to provide leadership, infrastructure, financial, human resources, legal, contract management, risk management, workplace health and safety, corporate governance and IT services across the organisation. The team's objective is to enable all AWRI staff to focus on their core capabilities to ensure that the organisation is able to meet its

objectives, and in turn the expectations of its stakeholders. The team works closely with the AWRI Board, which provides additional leadership and oversight to all AWRI activities.

### Business development/commercialisation

During the year, a range of agreements were progressed and finalised to support business operations, including several memoranda of understanding, non-disclosure agreements and materials transfer agreements. Important outcomes for the year included securing funding for Metabolomics SA from the Australian and South Australian Governments for 2023-2028, obtaining a CRC-P grant over three years for NOLO research, and establishing strategic partnership agreements with the University of Adelaide and Campden BRI. Collaborative efforts with the University of Adelaide led to the launch of the NOLO trial-scale research facility. Various grant funding applications and agreements were developed, including one with Wine Victoria to assist delivery of the Growing Victorian Wine into the Future program and one with PIRSA and Wine Grape Council of SA to support the Farm Business Resilience program. AWRI commercialised the yeast strain AWRI 141 (*Schizosaccharomyces pombe* – trade name AB Mauri Pinnacle SP) with AB Mauri, primarily for use in distilled spirits production.

### Finance

Core finance activities included the provision of accounting, budgeting, accounts receivable and payable, payroll, management of cashflow and liquidity, and compliance with internal financial policies. The finance team also provided reporting to AWRI's management and Board, funding organisations and statutory bodies. Other notable activities included the provision of administrative support for entities such as the Australian Wine Industry Technical Conference, Interwinery Analysis Group and the Wine Innovation Cluster.

### Human resources

The AWRI's human resources capability is responsible for ensuring AWRI's compliance with employment conditions and regulations. It manages day-to-day employment activities such as the induction of new staff, monitoring the performance management framework and managing employer of choice initiatives. AWRI continues to run a Leadership Development Program in line with its strategic objective of attracting and retaining world-class talent.

The annual HR survey revealed that the vast majority (86%) of employees considered AWRI an employer of choice by confirming that "all things considered, the AWRI is a great place to work". This represented a small decline in employees' positive attitudes towards the organisation from the previous year (94%), linked primarily to concerns about job security amid funding uncertainty.

### Operations

The Operations and Research Laboratory Manager oversees all AWRI infrastructure, equipment and engineering requirements; supervises procurement of consumables; and chairs the AWRI's Safety Advisory Committee. Safety remained a primary focus, with risk assessments, training and staff engagement used on a continuous basis to foster a culture of safety compliance. Regular inspections and prompt repairs to laboratory and building equipment ensured a seamless environment for research activities throughout the year. Significant cost savings were delivered through regular reviews of procurement decisions, especially in the areas of laboratory consumables and scientific gases. Further responsibilities included chairing the AWRI's

Institutional Biosafety Committee, maintenance of Office of the Gene Technology Regulator accreditation, auditing and maintenance of Physical Containment Level 2 (PC2) laboratory facilities, and administration of permits for a range of activities such as dangerous goods handling.

### **Corporate governance and legal support**

The AWRI's corporate governance and legal capability assists the effective functioning of the AWRI Board while providing legal support to all teams within the organisation and ensuring that the AWRI continues to meet its legal obligations. During the year the AWRI Board welcomed a new Chair, Professor Kiaran Kirk, following the retirement of long-standing Chair Louisa Rose in December 2022. The Board also welcomed the first Directors appointed under the new appointment and election processes approved by Members in February 2022. In particular, the first Director elected by Grape Research Levy payers joined the Board. Other activities included the conduct of an internal review of the Board and its processes, maintaining and updating the organisation's strategic and operational risk registers, general policy review and contract management.

### **Information technology and knowledge management**

AWRI continued to improve its cyber-security resilience throughout the year, aligned with its strategic risk assessment and a Board priority. Key activities included removing administration privileges from users, implementation of multi-factor authentication for VPN connections and applying the latest security patches. AWRI has also made significant improvements to its 'Microsoft secure score' (a measurement of an organisation's security posture) moving from a 46% rating to an 84% rating over the course of the year (average industry score for similar-sized organisations is 56%).

Beyond the activities focused on cyber-security, the IT team continued to provide a helpdesk service to staff (managing more than 1,300 tickets), and provided a stable IT environment for the organisation.

### **Marketing**

The AWRI's marketing capability provides expert marketing guidance to the overall organisation and is responsible for the development and execution of marketing strategies, campaigns, events and digital content. After the successful launch of the refreshed AWRI

masterbrand, the focus this year has been on implementing the brand across AWRI and development of a series of consistent 'tiles' for marketing specific AWRI events and activities.

## **Affinity Labs**

### **Background**

Affinity Labs serves an important role in the Australian grape and wine industry, providing internationally recognised and accredited reference laboratory services, proof-of-performance testing, consulting services, microbiological and molecular analysis, grapevine virus testing and the design and implementation of trials and research for industry, covering all aspects of the production chain from viticulture to packaged wine. Affinity Labs also continues to be actively involved in pre-competitively funded applied research projects and provides services to the broader agricultural industry and producers of other foods and beverages.

### **Improving systems and service**

During the year, Affinity Labs continued its core goal of being the Australian wine industry's leading partner in the provision of technical and testing services. A major focus was on the continual advancement of systems to improve customer experience, making it easier to access services. This is most obvious in the new Affinity Labs website, which guides customers through the process of ordering services as well as giving useful information on the testing provided and how different tests best fit different customer needs. Internally, the laboratory information management system underwent a major upgrade, increasing efficiency and flexibility in how data is managed and reported to customers. This upgrade will provide the basis for further improvements for customers over the coming year, allowing more flexible reporting and direct access to historical results. The business's customer service team has also been significantly expanded to ensure optimal service.

Affinity Labs had a strong year despite its core wine industry customers facing difficult market conditions. Total sample numbers for 2022/23 (23,094) were 15% lower than the three-year (2020 to 2022) average (27,166), reflecting the overall reduction in the Australian crush, which was around 26% lower than the long-term average. These reduced sample numbers saw revenue from grape



and wine down by 13%. Affinity Labs, however, still managed to meet its revenue targets, mostly through increased trace analysis on non-grape and wine samples. This is an important result as this non-grape and wine work allows Affinity Labs to keep up the high technological and service base to support our core wine industry clients. Customer numbers grew by 136, more than 35% of which were from the wine and grape sector. This growth in customer numbers was 20% higher than last year.

### Investing in getting it right

An accredited facility such as Affinity Labs is only as good as the results it produces. To achieve the very best outcomes, Affinity Labs is expanding the range of proficiency testing programs it participates in. This year the laboratories participated in 16 rounds of testing offered by bodies including the Interwinery Analysis Group, the International Bureau of Analytical Studies, the National Measurement Institute and the Brewing Interlaboratory Reference Analysis. In all of these programs Affinity Labs demonstrated industry-leading results, meeting all acceptability criteria.

Affinity Labs is also actively developing new proficiency programs. Based on the success of the previous year's smoke marker ring test, where 19 laboratories from four continents tested smoke-affected wines, an international pilot program was launched to see if similar interlaboratory testing on dried grape homogenate samples was practical. This program was highly successful and a full program involving laboratories in Australia, Europe, Africa, North and South America will be undertaken in the second half of 2023. This will provide valuable confidence in smoke testing as Australia moves towards the 2024 vintage. A program of laboratory comparisons for virus testing was also undertaken with the two main laboratories that offer this service. The laboratories tested equivalent samples

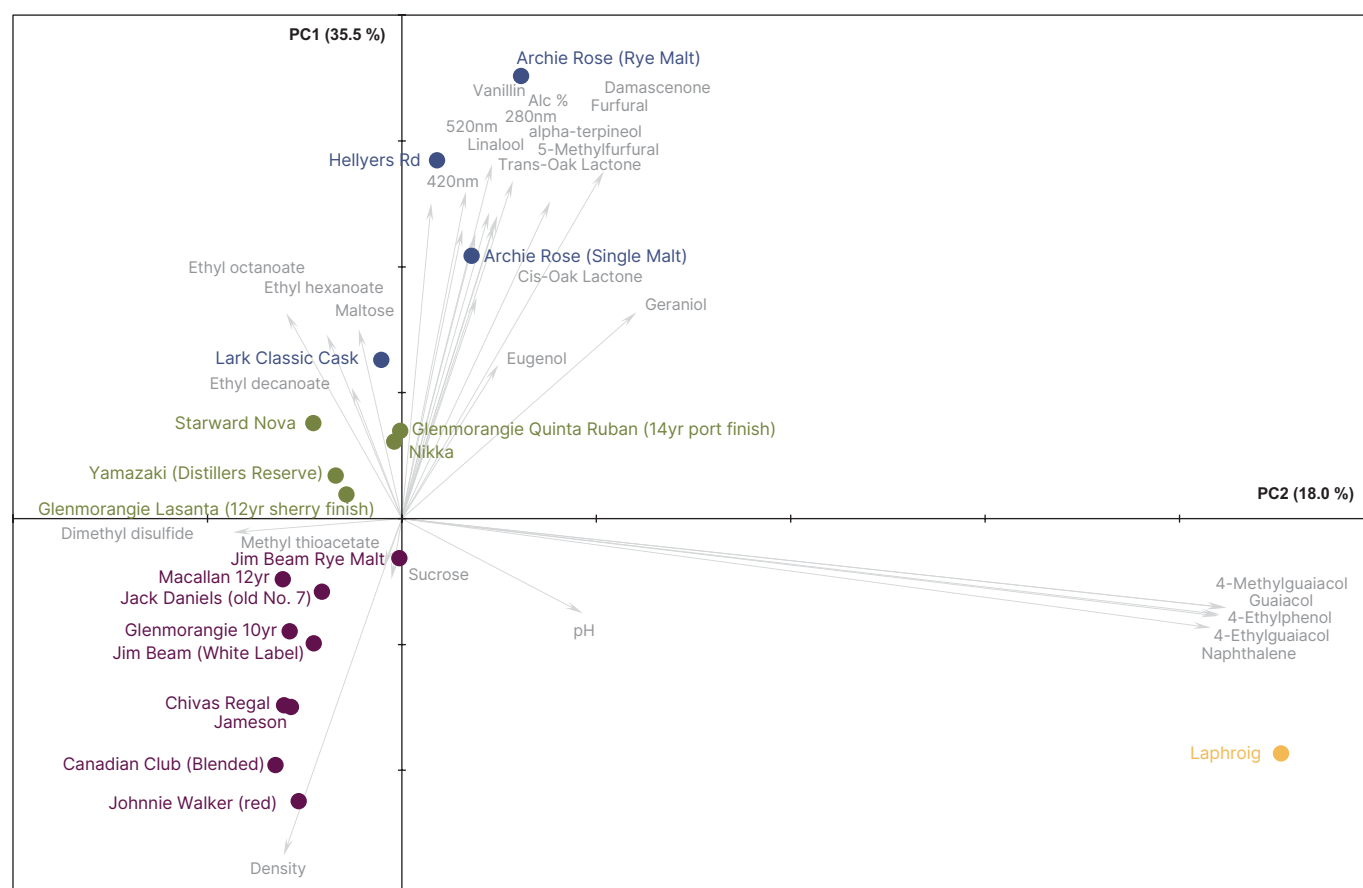
and showed good alignment of results. The success of this program led to plans for a more structured program that will be open to all laboratories offering grapevine virus testing in Australia.

### Adding new capabilities

The year Affinity Labs continued to add capabilities to its already extensive services. A major investment was made to allow testing of the fungicide phosphorous acid to be conducted in-house, leading to a significant price reduction and reduced turnaround time. This was especially timely as the 2022 vintage was cool and wet, requiring an increased use of this agrochemical in the vineyard and therefore increased testing of wines destined for export markets. The trace analysis laboratory also continued to add new active compounds to its standard residue screen in line with changing industry requirements.

Affinity Labs also introduced new tests to support NOLO producers, with a new capability to test wines below 0.05% alcohol. This is an important requirement because some markets require an extremely low tolerance for products to be labelled as containing no alcohol. In parallel, many of the standard wine analyses offered for traditional wines were validated for products between 0.5 and 4.5% alcohol to ensure they are applicable to the low-alcohol category.

In spirits testing, a benchmarking study was completed, comparing the sensory and chemical composition of commercial whiskeys from around the world. This program grouped the various products by both sensory and analytical characteristics, giving an understanding of how they differed sensorially and which compounds were responsible for these differences (Figure 19). In future this will be an important tool for local producers, enabling them to benchmark their own products and modify production practices to target specific market segments and product outcomes.



**Figure 19.** Principal component analysis plot of whiskey benchmarking study, showing chemical differences across 18 commercial whiskey samples. Colours reflect the grouping of whiskeys, according to hierarchical clustering analysis. The direction of each arrow shows the influence of individual chemical components on the differences across the sample set and arrow length indicates the importance of each parameter on the clustering.





## Marketing

Continuing the momentum of Affinity Labs' launch, marketing initiatives have focused on building brand awareness and attracting new business. Particular attention was placed on growing market share in the wine industry and attracting new customers from the brewing and distilling industries. A comprehensive advertising campaign was delivered across a variety of print and digital platforms. This was supported by a PR campaign that saw articles published in the national magazine, *Drinks Trade*. Sponsorship opportunities were also used to ensure the new branding was promoted across industry. The continual development of the Affinity Labs website has seen the addition of web forms for online ordering of analytical and plant testing services. This has streamlined the ordering process for customers and improved processing efficiency through the customer service team.

## Forging partnerships for success

This year Affinity Labs initiated a strategic partnership with the UK's largest food and beverage testing group, Campden BRI. The strategic partnership with this internationally recognised and active organisation will support an exchange of capabilities and knowledge to broaden the technical basis of the two organisations. For Affinity Labs, this will allow much faster implementation of new tests in the non-wine beverage and food sectors, as well as valuable intelligence on the changing European market landscape that will help Australian producers meet changing import requirements. It will also see the AWRI cooperate in establishing a new wine testing facility in the UK, bringing the AWRI's almost 70 years of knowledge in wine testing and production to the rapidly growing UK wine industry.

Affinity Labs is also developing regional partnerships to ensure that it is easier for Australian customers to access its industry-leading testing and services. Sample drop-off points are being launched in selected Australian regions to make it simpler and cheaper to get samples to Affinity Labs in Adelaide. Three of these facilities, in Merbein, Yarra Valley and Hunter Valley, will be in action before the end of 2023.

## Research services

### Background

The provision of complex instrumentation, testing facilities and highly specialised analytical methods is a basic element of modern scientific research. This project ensures access to expertise such as sensory evaluation, grape and vineyard sourcing, organic synthesis and purification of rare compounds, statistical analysis and running of advanced chemical analysis systems.

### Sensory analysis

In the past 12 months, there has been consistently strong demand for sensory services, from both research and commercial clients. Nine large descriptive analysis studies and 21 technical quality panel sessions were completed. Four additional descriptive sensory tests were conducted, involving Pivot® Profile, napping and time intensity sensory methodologies. Sensory threshold testing of the amino acid

proline was also conducted in two white wines and two red wines. Thirteen difference test sessions and 17 preliminary 'bench tastings' were also undertaken. New AWRI staff were incorporated into the difference testing panel pool. The AWRI's smoke sensory panel continued its work evaluating potentially smoke-affected wines as a service to Australian grapegrowers and winemakers. Nine smoke panel sessions were convened over the year.

### Analytical chemistry support

Several analytical methods for aroma compounds using gas chromatography-mass spectrometry were developed and others were upgraded to increase sample throughput and/or decrease limits of detection. These new and improved methods have already been applied to current research projects.

### AWRI wine microorganism culture collection

The culture collection underwent a period of revision and consolidation. During the year 300 microorganisms were added to the collection, representing secure, long-term storage of research project outputs. A total of 260 microorganisms were distributed internally and 24 distributed to external parties. A stocktake was also undertaken of collection holdings to ensure the long-term viability of existing cultures.

## WIC Winemaking Services

### Background

Wine Innovation Cluster (WIC) Winemaking Services is based at the Hickinbotham Roseworthy Wine Science Laboratory and is a joint venture between the AWRI and the University of Adelaide that was established in 2010. Its location within the University of Adelaide's purpose-built small-lot and pilot-scale winemaking facility on the Waite Campus enables the delivery of high-quality research and small-scale commercial winemaking services.

### 2023 vintage

WIC Winemaking Services had a very low research winemaking year in 2023, processing 57 research wines (6-100 kg) and receiving nine parcels of trial wine from offsite for bottling preparation and packaging. A much larger volume of commercial wine was made, with 14 batches (0.4-2 tonne) during the 2023 vintage. For these 14 batches, 11 tanks and 24 barrels are being managed, doubling the barrel inventory of 2021 and 2022 wines. The wines processed were 31% white (60% in 2022) and 69% red (40% in 2022). Total fruit intake was 22.6 tonnes, up from 19 tonnes in 2022. Overall, while total ferment numbers were down significantly, total tonnage was comparable to a typical year.

A cool start to the season saw a delayed start to vintage, with the first fruit arriving on 22 February, a week later than 2022. There was then a lull in fruit intake until 13 March. Unlike previous years, there was no peak intake week, with a constant supply of fruit from mid-March through to 25 April. The last fruit arrived on 4 May, a week later than 2022. There will be another full off-season of agrochemical studies in the second half of the calendar year and new NOLO project work, which will provide an ongoing stream of work to complement bottling operations.

A key achievement during the year was the installation and commissioning of equipment for processing and packaging NOLO wines, sourced as part of a grant from the South Australian Government. A research-scale spinning cone column is the centrepiece of the NOLO trial-scale facility, which is being managed by WIC Winemaking Services.

WIC Winemaking Services is also increasing its capability in non-wine-related beverage services. In one project, the team worked with a family company from the Riverland assisting in the production of a date liqueur using a combination of fresh and dried dates, as well as a date paste. The team also completed some initial trial work on a shelf-stable kombucha product that does not require refrigeration post-packaging.

## Metabolomics and bioinformatics service platforms

### Background

The AWRI established the South Australian node of Metabolomics Australia (Metabolomics SA) in 2008 as part of the national collaborative research infrastructure strategy (NCRIS) network with partners in WA, Victoria and Queensland and funding provided by Bioplatforms Australia and the South Australian Government. Metabolomics SA operates as a collaborative service platform that provides public and private researchers and industries with support, services and training, as well as access to infrastructure and specialist expertise.

### New lipidomics capability in SA

During the year, a new high resolution mass spectrometer was installed and successfully commissioned. This instrument will be used specifically to support the food, agriculture and environmental sectors with characterising large numbers of structurally related compounds, for example, as required for lipid profiling. The broad lipid profiling capability targets more than 650 lipids from 21 different classes and is applicable to multiple matrices. Lipids are an important component of plants, food and animals and cover a variety of functions such as energy storage, nutrient transport, regulation and signalling. Understanding the diversity in lipid composition has, therefore, become fundamental to interpreting biological processes.

### Quality management system

The Metabolomics SA team is committed to operating a quality management system. During the year, certification was obtained from SAI Global by conforming to the requirements of ISO9001:2015 in the scope of specialist services for the analysis of small organic molecules.

## Tracking trends in vineyard and winery practices

### Background

In 2016 the AWRI conducted its first survey of Australian vineyard and winery practices. Results from this survey provided a detailed snapshot of practices being used in vineyards and wineries across Australia, and were used to help inform grape and wine R&D and extension activities. A detailed report was published and is available from the AWRI website.

### Second edition of vineyard and winery practices survey

The second edition of the AWRI Vineyard and Winery Practices Survey was conducted in late 2022. While the data is still being analysed, preliminary results have been drawn upon in the design of a range of AWRI projects. An industry webinar was also delivered on the new products or techniques nominated by respondents as having the biggest positive impact on their operations. The final report will be published in 2024.

# Environmental, social and governance report

Over the past year, environmental, social and governance (ESG) performance has been identified as a key priority by the AWRI Board. The overall objective is for the AWRI to demonstrate ESG best practice through understanding, continually improving and reporting against performance in these areas.

As a first step, in 2023 the AWRI appointed an ESG committee to assist the Executive Management Group in identifying, measuring and monitoring key ESG/sustainability goals and planning, implementing and monitoring actions to achieve those goals. The ESG committee's main tasks are to:

- Assist in the development of an ESG strategy
- Provide advice and direction on implementation of the ESG strategy
- Advise on opportunities and risks for the AWRI's operations, reputation and corporate responsibility
- Assist in establishing, reviewing and reporting against a set of agreed ESG metrics and suggesting opportunities for improvement
- Support engagement with AWRI staff on ESG matters.

To support efforts to establish appropriate ESG metrics, the AWRI was awarded an Assess-Implement-Monitor (AIM) grant by Green Industries SA as part of its Business Sustainability Program 2022/23. The grant is being used for a project that is identifying and prioritising opportunities for reducing Scope 1, 2 and 3 greenhouse gas emissions for the business. The assessment will provide a clear path of action towards net zero emissions, and is covering two sites: the main AWRI office space and the research winemaking facility. The two-year action plan that will be developed from this project will also form the basis for future ESG reporting.



The background image shows a large industrial food processing facility. In the foreground, a woman and a man, both wearing bright yellow high-visibility safety vests, are working with large, white, cylindrical stainless steel vats. The woman is on the left, looking into one of the vats, while the man is on the right, using a tool to work on the lid of another vat. The facility has a high ceiling with exposed metal beams and industrial lighting. In the background, there are more vats, pipes, and a walkway with railings. The overall scene depicts a busy, professional manufacturing environment.

# AWRI Financial statements

for the year ended 30 June 2023



# Directors' report

The Directors present this report to the members of The Australian Wine Research Institute Limited (the Company) for the year ended 30 June 2023.

## Directors

The names of each person who has been a Director during the year and to the date of this report are:

	Date of appointment	Cessation date	Board meetings	
			A	B
Ms Louisa E. Rose (Chair until 31 Dec 2022)	1 Jan 2011	31 Dec 2022	2	2
Mr Tobias J. Bekkers	1 Jan 2014	31 Dec 2022	2	2
Mr Andrew J. Clarke	1 Jan 2023	–	3	3
Hon Sarah J. Courtney	1 Nov 2022	–	4	4
Mr Wayne I. Ellis	1 Jan 2023	–	3	3
Ms Patricia Giannini	16 Sep 2020	–	5	5
Prof. Kieran D. Kirk (Chair from 1 Jan 2023)	1 Jan 2017	–	5	5
Dr Mark P. Krstic	1 Feb 2020	–	5	5
Ms Courtney L. Ribbons	1 Sep 2022	31 Dec 2022	2	2
Ms Elizabeth A. Riley	1 Jan 2012	–	5	5
Mr Brett M. McClen	1 Jan 2022	–	5	5
Mr T. Nigel Sneyd	1 Jan 2022	–	5	5
Ms Corrina N. Wright	1 Jan 2022	–	5	5

**A** – number of meetings attended

**B** – number of meetings held during the time the director held office during the year

Directors have been in office for the duration of the financial year unless otherwise stated.

## Overview of result

For the year ended 30 June 2023 the Company recorded a deficit of \$629,646 (2022: deficit of \$1,601,520). This deficit primarily relates to a reduction of \$2.4m in funding from Wine Australia (when compared to the previous year). This reduction is attributable to the timing of the commencement of a new Investment Agreement with Wine Australia (the WA Investment Agreement) for the period 2022-2026. In addition to the reduction, delays in the formal commencement of the next stages for projects under the WA Investment Agreement, together with budget over-runs, resulted in the Company incurring an additional \$0.6m of costs which it has effectively underwritten. The impact of the reduction was partially offset by an increase of \$0.8m in grant funding from other parties, an increase of \$0.6m in commercial income, together with \$0.6m in savings from the costs of operational activities. Notwithstanding these mitigations, the Company was faced with significant demands on working capital during the course of the year and, accordingly, reduced its investment holdings to support its operating activities, the result of which is reflected in both its balance sheet and statement of cash flows.

## Other material developments

Under the WA Investment Agreement, there is a mechanism that allows for a proportional reduction in funding as a result of lower vintage volumes and consequently levies collected from wine-grape growers. In November 2022 the Company was informed that it would be subject to a reduction of circa \$1.5m in its funding as a result of lower vintage volumes dropping beneath floor thresholds. This reduction would take effect in the financial year ending 30

June 2024. The Company is continuing to work with Wine Australia to implement the effects of the funding reduction across its contracted activities. Despite the material impact of the funding reduction on its revenues, the Company's balance sheet remains strong, allowing it to continue its operations in the upcoming and future years.

## Objectives and strategy

The Company's long-term objective is to support the Australian grape and wine industry through world-class research that results in practical solutions and the dissemination of knowledge and leading practices.

The Company's short-term objectives are reflected in its 8-Year Research, Development and Extension Plan which was developed through a wide-ranging industry consultation process and formally commenced on 1 July 2017. This plan details 21 subthemes of activities designed to contribute to the achievement of the Company's mission, grouped within five main themes:

- *Customers, consumers and markets*
- *Extension, adoption and education*
- *Performance, products and processes*
- *Environment, sustainability and natural capital*
- *Foundational data and support services.*

Within these subthemes are 50 projects focusing upon specific outcomes. For each active project a project plan specifies relevant stakeholder needs, deliverables, approaches and methodologies as well as expected outcomes of benefit to the Australian wine industry. The consultation process with industry and other stakeholders remains ongoing, with active projects further developed and refined through annual operating plans.

The Company's strategy for achieving the above objectives is to maximise its available funding to enable the delivery of projects within its Research, Development and Extension Plan, while optimising its internal operations and resources to ensure that such funding is applied as effectively and efficiently as possible. This strategy is implemented through a suite of initiatives, collectively described in the internal document *AWRI Directions - Business and Operational Initiatives 2022-2023*, clustered into five themes:

- *Best practice governance and organisational structure*
- *World-class people and culture*
- *AWRI business infrastructure, systems and processes*
- *Future funding, capabilities and services*
- *Relationships, partnerships, engagement and communications.*

The 8-Year Research, Development and Extension Plan, together with a status summary of the projects within the plan, is available online at [awri.com.au](http://awri.com.au).

## Principal activities

The Company's principal activities during the year were:

- **Research** activities that strive for scientific excellence and industry relevance
- **Development** activities that seek to bridge the gap between scientific discovery and value-adding technology or processes
- **Extension** activities that seek to disseminate research and development outcomes to facilitate rapid uptake by the viticultural and winemaking sectors
- **Commercial** services, delivered via its Affinity Labs brand, aimed at providing competitive specific and/or tailored solutions for individual entities across all industry sectors which leverage the other key activities of the AWRI.

These activities collectively constitute a mechanism to implement the strategies outlined in *AWRI Directions - Business and Operational Initiatives 2022-2023*, enabling the achievement of the long- and short-term objectives of the Company as articulated above.

## Performance measures

The Company measures its performance through considering the number, quality and impact of the AWRI's scientific publications; its research and development outcomes; the extent to which those outcomes have been adopted by industry practitioners to improve the quality and consistency of wine produced in Australia; and the extent to which that new knowledge has enabled the Australian wine industry to be successful in established and emerging markets. Progress against specific objectives is monitored through the achievement of specific milestones, outputs and performance targets as articulated in *AWRI Directions - Business and Operational Initiatives 2022-2023*, the 8-Year Research, Development and Extension Plan and individual project plans. Aspects of the Company's performance are also informed through its extension platforms including metrics relating to awareness, adoption, value creation and service quality, generated through engagement with stakeholders, which consists predominantly of grapegrowers and winemakers. Financial performance measures include the value of funding and grants received, demand for the organisation's commercial services and contract research capabilities, and performance relative to budget. From time to time the Company or parts of its operations are subject to independent review against externally established criteria, with the outcome of such reviews contributing to the Company's assessment of its own performance.

## Information on Directors

**Ms Louisa E. Rose** Chair (non-executive) until 31 December 2022

**Qualifications** BAppSc (Oen), BSc, GAICD

**Experience** Head of Winemaking at the Yalumba Wine Company and Hill-Smith Family Vineyards, Chair of the Alumni Council of the University of Adelaide and Chair of the Council of Barons of Barossa. Previously Director of the Barossa Grape & Wine Association, member of Wine Barossa and Co-Chair of the South Australian Wine Industry Council. National wine show judge, 31 years' technical, winemaking, viticultural and commercial experience in the Australian wine industry.

**Special responsibilities** Ms Rose was the Chair of the Personnel committee.

**Prof. Kiaran D. Kirk** Chair (non-executive) from 1 January 2023

**Qualifications** BSc (Hons), PhD, DPhil

**Experience** Dean of the College of Science at the Australian National University (ANU) and Chair of Clonakilla Wines. Previously Director of ANU Research School of Biology, Head of ANU Department of Biochemistry and Molecular Biology, and Research Fellow at University of Oxford. More than 27 years' experience in the Australian research sector with a publication record of over 160 research papers in the field of biochemistry. Fellow of the Australian Academy of Health and Medical Science and Member of the Order of Australia.

**Special responsibilities** Prof. Kirk is the Chair of the Personnel committee.

**Mr Tobias J. Bekkers** Non-executive Director until 31 December 2022

**Qualifications** BAppSc (Ag) (Hons), GradCert (Mgt), GAICD

**Experience** Principal of Bekkers Consulting and Bekkers Wine. Active as a viticulture and wine business consultant across Australia. Twenty-eight years' experience in viticulture and wine business. Formerly General Manager/Senior Viticulturist of Paxton Wines. Previously Director of the McLaren Vale Grape, Wine and Tourism Association. Graduate of the Australian Wine Industry Future Leaders Program and Nuffield Farming Scholar (2017).

**Special responsibilities** Mr Bekkers was a member of the Nominations committee.

**Mr Andrew J. Clarke** Non-executive Director

**Qualifications** BViticOen, GAICD

**Experience** Viticultural advisor based in Bendigo, Victoria, with 20+ years' experience across multiple regions and states in vineyard management and grape supply, including as chief viticulturist with Yering Station. Strong connections to the Agtech sector, grower community, research, government and industry bodies, combined with proven governance training and experience. President of the ASVO and previously on the Victorian WineMAC and the board of VineHealth Australia. A Nuffield Scholar and a Graduate of the Australian Wine Industry Future Leaders Program.

**Hon Sarah J. Courtney** Non-executive Director

**Qualifications** BE (Chem) (Hons), BCom (Finance), MWineTech, GAICD

**Experience** Owner of Fish Hook Wines in Tamar Valley, Tasmania. Served as a Minister in the Tasmanian Government, holding a number of senior portfolios including Primary Industries and Water, and was Minister for Health during COVID-19. Was also the Shareholder Minister for several state-owned businesses, including Tasmanian Irrigation, TasTAFE and Tourism Tasmania. Previously based in Sydney, working for almost a decade in the financial services industry across equity analysis, institutional sales and quantitative analysis. Currently Independent Chair of East 33, a vertically integrated Sydney Rock Oyster company.

**Special responsibilities** Ms Courtney is a member of the Audit committee.

**Mr Wayne I. Ellis** Non-executive Director

**Qualifications** BApplMgt

**Experience** General Manager at Duxton Vineyards. Highly experienced operations leader with a background in operational and supply chain management spanning 25 years. Is responsible for the safe and sustainable management of more than 2,400 hectares of wine-grapes in the Murray Darling region in his current role, as well as Duxton's 80,000-tonne winery (previously Stanley winery). Has extensive experience across a wide range of industry sectors including wine, project management, supply chain management and operational management in the electronics industry.

**Special responsibilities** Mr Ellis is a member of the Personnel committee

**Ms Patricia Giannini** Non-executive Director

**Qualifications** BEc, GradDipAcc, CA

**Experience** Over 25 years' experience in large corporate entities and public practice including within the audit division of 'Big Four' accounting firm KPMG, as well as a range of CFO and consulting roles, including advising within M&A, capital raising and business strategy. Has been a facilitator in Audit and Financial Reporting for the Institute of Chartered Accountants. Experience spans a wide range of sectors including technology, agriculture, food and beverage, manufacturing and mining.

**Special responsibilities** Ms Giannini is the Chair of the Audit committee.

**Dr Mark P. Krstic** Managing Director

**Qualifications** BAgSc (Hons), PhD, MBA, GAICD

**Experience** Chair of The Australian Wine Industry Technical Conference, Director of the National Wine Foundation, Director of the South Australian Genomics Centre, professional member of the ASVO and ASEV, member of Horticulture Innovation's Table Grape Strategic Investment Advisory Panel, Co-Chair of the Wine Steering Committee, Associate Editor of the *Wine & Viticulture Journal*, member of the Wine Innovation Cluster Leadership Group and the Waite Strategic Leadership Group, member of Sustainable Winegrowing Australia Joint Steering Committee, member of OENOVIT and BAG Alliance Executive Committee, Honorary Senior Fellow at the University of Melbourne, Adjunct Professor at Macquarie University. Graduate of the Australian Wine Industry Future Leaders Program and 2020 ASVO Viticulturist of the Year.

**Mr Brett M. McClen** Non-executive Director

**Qualifications** BAgSc (Hons), MBA

**Experience** Head of Viticulture & Sustainability at Brown Family Wine Group. More than 20 years' viticultural and management experience across a range of Australian wine regions, as well as experience working with other irrigated horticultural crops. Professional member and previously a director of the ASVO, finalist in the 2019 ASVO Viticulturist of the Year award.

**Special responsibilities** Mr McClen is a member of the Audit committee.

**Ms Courtney L. Ribbons** Non-executive Director until 31 December 2022

**Qualifications** BCom, CPA, GAICD

**Experience** Supply Chain Operations Manager for Pernod Ricard Winemakers. More than 18 years' experience in the wine industry across a broad range of areas including finance, manufacturing, operations and domestic and international supply chains. Board member of Barossa Australia, member of The Drinks Association Supply Chain & Logistics Forum and previously a committee member of the Women in Drinks South Australian chapter.

**Special responsibilities** Ms Ribbons was a member of the Audit committee.

**Ms Elizabeth A. Riley** Non-executive Director

**Qualifications** BAppSc (Wine Sci), CertIV TAE, GAICD

**Experience** Managing Director and Viticulturist at Vitibit Pty Ltd with 29 years' experience in the Australian wine industry. Nuffield Farming Scholar, professional member of the ASVO, corporate partner of the Hunter Valley Wine and Tourism Association (HVWTA), member of the HVWTA Wine Innovation Forum, and member of the National Wine Biosecurity Committee. Previously an Executive member of the NSW Wine Industry Association and Chair of its Research and Development Committee. Formerly a Viticulturist with Southcorp Wines (between 1993 and 1999) in national and NSW-based roles. 2017 ASVO Viticulturist of the Year, 2020 recipient NSW DPI Graham Gregory Award, 2022 Wine Magazine Viticulturist of the Year, and 2023 Wine Communicators of Australia 'Legend of the Vine'.

**Special responsibilities** Ms Riley is a member of the Nominations committee.

**Mr T. Nigel Sneyd MW** Non-executive Director

**Qualifications** BAppSc (Wine Sci), DipNat (Oenol), MBA, GAICD

**Experience** More than 40 years' domestic and international experience in the wine industry, including time spent with Brown Brothers Milawa, Hickinbotham Winemakers, Domaine Dujac, INRA, Champagne Krug, Evans & Tate, The Australian Wine Research Institute, BRL Hardy's Domaine de la Baume, Abbots SARL as well as 15 years with E. & J. Gallo based firstly in Europe and then in California with exposure to winemaking in Italy, Spain, Germany, South Africa, California, Argentina and New Zealand. Most recently was Global Director of Wine, Quality and Compliance for Accolade Wines and now an independent consultant in the wine industry. Has been responsible for delivery of significant cross-functional projects in large-scale and boutique-scale wine production in diverse cultural settings.

**Special responsibilities** Mr Sneyd is a member of the Personnel committee.

**Ms Corrina N. Wright** Non-executive Director

**Qualifications** BCom, BAgSc (Oen), MAICD

**Experience** Owner and winemaker for Oliver's Taranga Vineyards and owner of Swell Brewing Co. Advisory Board member of the Australian Women in Wine Awards, and previously a director of the Winemakers' Federation of Australia and McLaren Vale Grape, Wine & Tourism Association. An active wine show judge and wine writer, Chair of the Australian Alternative Varieties Wine Show and 2019 ASVO Winemaker of the Year.

**Special responsibilities** Ms Wright is a member of the Nominations committee.

## Indemnification of officers and auditors

During the financial year, the Company paid a premium in respect of a contract insuring the Directors of the Company (named above), the Company Secretary, all members of the Company's Executive Management Group and members of the Biosafety Committee (a committee including two representatives who are not employees of the Company, charged with oversight of matters pertaining to the development and use of genetically modified organisms and required to be appropriately indemnified by the Office of the Gene Technology Regulator) against a liability incurred in their capacity as a director, secretary, executive or committee member to the extent permitted by the *Corporations Act 2001*. The contract of insurance prohibits disclosure of the nature of the liability and the amount of the premium.

The Company has not otherwise, during or since the end of the financial year, except to the extent permitted by law, indemnified or agreed to indemnify an officer or auditor of the Company or of any related body corporate against a liability incurred as such an officer or auditor.

## Members' guarantee

In accordance with the Company's constitution, each member (both during the time he or she is a member and within one year afterwards) is liable to contribute \$2 in the event that the Company is wound up. The total amount members would contribute is \$20 (2022: \$20).

## Auditor's independence

The auditor's independence declaration as required under section 60-40 of the *Australian Charities and Not-for-profits Commission (ACNC) Act 2012* is attached and forms part of the Directors' report for the financial year ended 30 June 2023.

Dated at Urrbrae on this the 19<sup>th</sup> day of September 2023.

This report is made in accordance with a resolution of the Directors, pursuant to subsection 60.15(2) of the *Australian Charities and Not-for-profits Commission Regulation 2022*.



**Kiaran D. Kirk**

Chair



**Mark P. Krstic**

Managing Director

## Declaration of independence

### Declaration of independence by Josh Carver to the Directors of the Australian Wine Research Institute Limited.

As lead auditor of The Australian Wine Research Institute Limited for the year ended 30 June 2023, I declare that, to the best of my knowledge and belief, there have been:

1. No contraventions of the auditor independence requirements of section 60-40 of the *Australian Charities and Not-for-profit Commission Act 2012* in relation to the audit; and
2. No contraventions of any applicable code of professional conduct in relation to the audit.



**Josh Carver**

Director

**BDO Audit Pty Ltd**

Adelaide, 29 September 2023



# Statement of profit or loss and other comprehensive income

For the year ended 30 June 2023

	Note	2023	2022
<b>Revenue from operating activities</b>			
Wine Australia			
Investment agreement project funding		6,715,062	8,711,047
Investment agreement capital funding		–	444,432
Other project funding		100,000	101,529
Other capital funding		–	–
Capital specific grant funding		788,516	306,569
Other grant funding		1,731,212	1,368,691
Commercial services analytical and consulting income		3,704,775	3,731,537
Contract research and other commercial income		2,135,648	1,620,208
Other revenue		806,234	350,267
Total revenue		15,981,446	16,634,280
Other income	2	–	188,030
<b>Expenses from operating activities</b>			
Personnel expenses	3	11,240,808	11,332,720
Analytical and project operating expenses		2,519,142	2,967,870
Infrastructure and general services expenses		1,607,883	1,354,784
Research funding contributions		340,879	1,095,050
Depreciation and amortisation expense	8,9,10	1,378,472	1,283,150
Travel expenses		410,040	103,987
Total expenses		17,497,224	18,137,561
<b>Results from operating activities</b>		(1,515,778)	(1,315,250)
<b>Finance income</b>		460,892	529,070
<b>Profit/(loss) for the period</b>		(1,054,886)	(786,180)
<b>Other comprehensive income</b>			
<b>Items that will not be reclassified subsequently to profit or loss</b>			
Gain/(loss) on revaluation of financial assets at fair value through other comprehensive income		425,240	(815,340)
<b>Total comprehensive income for the period</b>		(629,646)	(1,601,520)

The notes on pages 54 to 60 are an integral part of these financial statements.

# Statement of changes in equity

For the year ended 30 June 2023

	Retained earnings	Co-investment reserve	Strategic IT investment reserve	Financial assets at fair value through OCI reserve	Total equity
Balance at 1 July 2021	15,024,659	646,396	11,175	1,547,311	17,229,541
<b>Total comprehensive income for the period</b>					
Profit or loss	(786,180)	–	–	–	(786,180)
<i>Other comprehensive income</i>					
Realised gain/(loss) on revaluation of financial assets at fair value through other comprehensive income	–	–	–	221,455	221,455
Unrealised gain/(loss) on revaluation of financial assets at fair value through other comprehensive income	–	–	–	(1,036,795)	–
Total other comprehensive income	–	–	–	(815,340)	(815,340)
Total comprehensive income for the period	(786,180)	–	–	(815,340)	(1,601,520)
<b>Transfers between retained earnings and other reserves</b>					
Transfers to/(from) reserves	–	(25,000)	(11,175)	(221,455)	(257,630)
Transfers to/(from) retained earnings	257,630	–	–	–	257,630
Balance at 30 June 2022	14,496,109	621,396	–	510,516	15,628,021
Balance at 1 July 2022	14,496,109	621,396	–	510,516	15,628,021
<b>Total comprehensive income for the period</b>					
Profit or loss	(1,054,886)	–	–	–	(1,054,886)
<i>Other comprehensive income</i>					
Realised gain/(loss) on revaluation of financial assets at fair value through other comprehensive income	–	–	–	297,074	297,074
Unrealised gain/(loss) on revaluation of financial assets at fair value through other comprehensive income	–	–	–	128,168	128,168
Total other comprehensive income	–	–	–	425,242	425,242
Total comprehensive income for the period	(1,054,886)	–	–	425,242	(629,645)
<b>Transfers between retained earnings and other reserves</b>					
Transfers to/(from) reserves	–	(80,000)	–	(297,072)	(377,072)
Transfers to/(from) retained earnings	377,073	–	–	–	377,073
Balance at 30 June 2023	13,818,296	541,396	–	638,684	14,998,376

## Nature and purpose of reserves

### Co-investment reserve

The objective of the co-investment reserve is to provide funds for co-investment in specific funding opportunities, enabling the Company to access certain funding programs subject to the following requirements:

- That any co-investment be matched on at least an equal basis from externally sourced funds
- That co-investments create value over the medium to long term for the ultimate benefit of the Australian grape and wine sector
- That co-investments be made only in instances whereby the overall grant funds available to the Australian grape and wine sector are expanded - that is, excluding grant funding programs which already exist for the benefit of that industry.

### Strategic IT investment reserve

The objective of the strategic information technology (IT) investment reserve is to ensure that sufficient funds are available for appropriate strategic investment in the Company's IT capabilities, consistent with relevant strategic plans as developed and amended from time to time, approved by the Board of Directors. Resourcing to meet the Company's day-to-day operational IT requirements, as distinct from its strategic IT requirements, is provided by other funding sources as identified within the statement of profit or loss and other comprehensive income.

### Financial assets at fair value through Other Comprehensive Income (OCI) reserve

The reserve is used to recognise increments and decrements in the fair value of financial assets at fair value through Other Comprehensive Income.

The notes on pages 54 to 60 are an integral part of these financial statements.

# Statement of financial position

As at 30 June 2023

	Note	2023	2022
<b>Assets</b>			
Cash and cash equivalents	4	1,227,200	3,431,001
Trade and other receivables	5	1,919,272	1,775,309
Inventories	6	74,336	92,480
Prepayments		436,493	451,396
<b>Total current assets</b>		3,657,301	5,750,186
Financial assets at fair value through OCI	7	9,029,070	9,817,570
Property, plant and equipment	8	4,052,969	4,113,125
Intangible assets	9	604,803	506,131
Right of use assets	10	3,132,584	3,335,923
<b>Total non-current assets</b>		16,819,426	17,772,749
<b>Total assets</b>		20,476,727	23,522,935
<b>Liabilities</b>			
Payables and accruals	11	1,972,405	2,259,221
Contract liability	12	1,330,763	3,413,758
Provisions	13	1,933,656	1,923,465
<b>Total current liabilities</b>		5,236,824	7,596,444
Provisions	13	241,527	298,470
<b>Total non-current liabilities</b>		241,527	298,470
<b>Total liabilities</b>		5,478,351	7,894,914
<b>Net assets</b>		14,998,376	15,628,021
<b>Equity</b>			
Retained earnings		13,818,296	14,496,109
Co-investment reserve		541,396	621,396
Strategic IT investment reserve		–	–
Fair value reserve		638,684	510,516
<b>Total equity</b>		14,998,376	15,628,021

The notes on pages 54 to 60 are an integral part of these financial statements.



# Statement of cash flows

For the year ended 30 June 2023

	Note	2023	2022
<b>Cash flows from operating activities</b>			
Cash receipts from project grants and other income		12,853,742	17,001,179
Cash paid to suppliers and employees		(16,061,209)	(17,116,814)
<b>Net cash from operating activities</b>		(3,207,467)	(115,635)
<b>Cash flows from investing activities</b>			
Cash receipts from capital specific funding		734,661	697,146
Interest received		219,549	147,491
Dividends and imputation credits received		314,959	284,896
Proceeds from sale of property, plant and equipment		–	20,000
Acquisition of property, plant, equipment and intangibles		(1,426,525)	(1,584,608)
(Acquisition)/proceeds from disposal of financial assets		1,207,393	567,637
Payment of transaction costs related to financial investments		(46,371)	(53,283)
<b>Net cash used in investing activities</b>		1,003,666	79,279
<b>Net increase/(decrease) in cash and cash equivalents</b>		(2,203,801)	(36,356)
Cash and cash equivalents at 1 July		3,431,001	3,467,357
<b>Cash and cash equivalents at 30 June</b>	4	1,227,200	3,431,001

The notes on pages 54 to 60 are an integral part of these financial statements.

# Notes to the financial statements

## 1. Significant accounting policies

The Australian Wine Research Institute Limited (the “Company”) is a company limited by guarantee, domiciled in Australia, incorporated under the *Corporations Act 2001*, registered as a charity under the *Australian Charities and Not-for-profits Commission Act 2012* (ACNC Act) and endorsed by the Australian Tax Office (ATO) as a Deductible Gift Recipient (DGR) organisation under the general DGR category of ‘Approved Research Institute’.

The registered office of the Company and its principal place of business is:

Cnr Hartley Grove and Paratoo Road  
Urrbrae, SA 5064

The financial statements were authorised for issue by the Board of Directors on the 19<sup>th</sup> day of September 2023.

Australian Accounting Standards set out accounting policies that the Australian Accounting Standards Board (AASB) has concluded would result in financial statements containing relevant and reliable information about transactions, events and conditions. Material accounting policies adopted in the preparation of these financial statements are presented below and have been applied consistently to all periods presented in these financial statements, and have been applied consistently by the Company.

Where necessary, comparative information has been reclassified to achieve consistency in disclosure with current financial year amounts and disclosures.

### (a) Basis of preparation

#### (i) Statement of compliance

The financial statements of the Company are Tier 2 general purpose financial statements which have been prepared in accordance with the requirements of the *Australian Charities and Not-for-profits Commission Act 2012* and *Regulation 2022*, Australian Accounting Standards - Simplified Disclosures, Accounting Interpretations and other authoritative pronouncements of the AASB. The Company is a not-for-profit entity for financial reporting purposes under Australian Accounting Standards.

The Company is exempt from income tax under Section 50-5 of the *Income Tax Assessment Act 1997*, and accordingly no provision for income tax is included in these financial statements.

#### (ii) Basis of measurement

The financial statements, except for the cash flow information, have been prepared on an accruals basis and are based on historical costs except for some financial assets which are measured at fair value, and do not take into account changing money values.

#### (iii) Functional and presentation currency

The financial statements are presented in Australian dollars, which is the Company’s functional currency.

The Company is of a kind referred to in ASIC Legislative Instrument 2016/191 dated 1 April 2016 and, in accordance with that Legislative Instrument, all financial information presented has been rounded to the nearest dollar unless otherwise stated.

#### (iv) Use of estimates and judgements

The preparation of financial statements in conformity with Australian Accounting Standards requires management to make judgements, estimates and assumptions that affect the application of accounting policies and the reported amount of assets, liabilities, income and expenses. The estimates and associated assumptions are based on historical experience and various other factors that are believed to be reasonable under the circumstances, the results of which form the basis of making judgements about the carrying value of assets and liabilities that are not readily apparent from other sources.

The estimates and underlying assumptions are reviewed on an ongoing basis. Revisions to accounting estimates are recognised in the period in which the estimates are revised. The Company has identified the allowance for expected credit loss in respect of trade receivables (note 5), the useful lives of property, plant and equipment (note 8), amortisation period of intangible assets (note 9), right of use assets including its interest in the WIC Central building (note 10) and provisions for employee entitlements (note 13) and their respective note 1 accounting policies as areas under which significant judgements, estimates and assumptions are made, and where actual results may differ from those estimates under different assumptions and conditions.

#### (v) Changes in accounting policies

The Company has adopted all of the new or amended Accounting Standards and Interpretations issued by the Australian Accounting Standards Board (AASB) that are mandatory for the current reporting period.

The following Accounting Standards and Interpretations are most relevant to the Company:

*Conceptual Framework for Financial Reporting*  
(Conceptual Framework)

*AASB 1060 General Purpose Financial Statements - Simplified Disclosures for For-Profit and Not-for-Profit Tier 2 Entities*

### (b) Financial assets

Financial assets are initially measured at fair value. Transaction costs are included as part of the initial measurement, except for financial assets at fair value through profit or loss. Such assets are subsequently measured at either amortised cost or fair value depending on their classification. Classification is determined based on both the business model within which such assets are held and the contractual cash flow characteristics of the financial asset, unless an accounting mismatch is being avoided.

Financial assets are derecognised when the rights to receive cash flows have expired or have been transferred and the Company has transferred substantially all the risks and rewards of ownership. When there is no reasonable expectation of recovering part or all of a financial asset, its carrying value is written off.

#### *Financial assets at fair value through profit or loss*

Financial assets not measured at amortised cost or at fair value through other comprehensive income are classified as financial assets at fair value through profit or loss. Typically, such financial assets will be either: (i) held for trading, where they are acquired for the purpose

of selling in the short term with an intention of making a profit, or a derivative; or (ii) designated as such upon initial recognition where permitted. Fair value movements are recognised in profit or loss.

*Financial assets at fair value through other comprehensive income*  
Financial assets at fair value through other comprehensive income include equity investments which the Company intends to hold for the foreseeable future and has irrevocably elected to classify them as such upon initial recognition.

#### *Impairment*

The Company recognises a loss allowance for expected credit losses on financial assets which are either measured at amortised cost or fair value through other comprehensive income. The measurement of the loss allowance depends upon the Company's assessment at the end of each reporting period as to whether the financial instrument's credit risk has increased significantly since initial recognition, based on reasonable and supportable information that is available, without undue cost or effort to obtain.

Where there has not been a significant increase in exposure to credit risk since initial recognition, a 12-month expected credit loss allowance is estimated. This represents a portion of the asset's lifetime expected credit losses that is attributable to a default event that is possible within the next 12 months. Where a financial asset has become credit impaired or where it is determined that credit risk has increased significantly, the loss allowance is based on the asset's lifetime expected credit losses. The amount of expected credit loss recognised is measured on the basis of the probability weighted present value of anticipated cash shortfalls over the life of the instrument discounted at the original effective interest rate.

For financial assets measured at fair value through other comprehensive income, the loss allowance is recognised within other comprehensive income. In all other cases, the loss allowance is recognised in profit or loss.

### **(c) Property, plant and equipment**

#### **(i) Recognition and measurement**

Items of property, plant and equipment are measured at cost less accumulated depreciation and accumulated impairment losses. Cost includes expenditure that is directly attributable to the acquisition of the asset, including borrowing costs directly attributable to the acquisition, construction or production of a qualifying asset. Cost also may include transfers from other comprehensive income of any gain or loss on qualifying cash flow hedges of foreign currency purchases of property, plant and equipment. Purchased software that is integral to the functionality of the related equipment is capitalised as part of that equipment.

When parts of an item of property, plant and equipment have different useful lives, they are accounted for as separate items (major components) of property, plant and equipment.

Gains and losses on disposal of an item of property, plant and equipment are determined by comparing the proceeds from disposal with the carrying amount of property, plant and equipment and are recognised net within other income in profit or loss.

#### **(ii) Subsequent costs**

The cost of replacing a part of an item of property, plant and equipment is recognised in the carrying amount of the item if it is probable that the future economic benefits embodied within the part will flow to the Company, and its cost can be measured reliably. The carrying amount of the replaced part is derecognised. The costs of the day-to-day servicing of property, plant and equipment are recognised in profit or loss as incurred.

#### **(iii) Depreciation**

Depreciation is calculated over the depreciable amount, which is the cost of an asset, or other amount substituted for cost, less its residual value.

Depreciation is recognised in profit or loss on a straight-line basis over the estimated useful lives of each part of an item of property, plant and equipment, since this most closely reflects the expected pattern of consumption of the future economic benefits embodied in the asset. Leased assets are depreciated over the shorter of the lease term and their useful lives unless it is reasonably certain that the Company will obtain ownership by the end of the lease term.

The estimated useful lives for the current and comparative periods are as follows:

• buildings and improvements	30 years
• plant and machinery	3 – 10 years
• office furniture and IT	3 – 10 years
• laboratory equipment	3 – 10 years

Depreciation methods, useful lives and residual values are reviewed at each financial year-end and adjusted if appropriate.

### **(d) Intangible assets**

Intangible assets that are acquired by the Company and have finite useful lives are measured at cost less accumulated amortisation and accumulated impairment losses.

Amortisation is calculated over the cost of the asset, or another amount substituted for cost, less its residual value. Amortisation is recognised in profit or loss on a straight-line basis over the estimated useful lives of intangible assets from the date that they are available for use, since this most closely reflects the expected pattern of consumption of the future economic benefits embodied in the asset. Amortisation methods, useful lives and residual values are reviewed at each financial year-end and adjusted if appropriate.

### **(e) Leased assets**

#### *Lease liabilities*

A lease liability is recognised at the commencement date of a lease. The lease liability is initially recognised at the present value of the lease payments to be made over the term of the lease, discounted using the interest rate implicit in the lease or, if that rate cannot be readily determined, the entity's incremental borrowing rate. Lease payments comprise of fixed payments less any lease incentives receivable, variable lease payments that depend on an index or a rate, amounts expected to be paid under residual value guarantees, exercise price of a purchase option when the exercise of the option is reasonably certain to occur, and any anticipated termination penalties. The variable lease payments that do not depend on an index or a rate are expensed in the period in which they are incurred.

Lease liabilities are measured at amortised cost using the effective interest method. The carrying amounts are remeasured if there is a change in the following: future lease payments arising from a change in an index or a rate used; residual guarantee; lease term; certainty of a purchase option; and termination penalties. When a lease liability is remeasured, an adjustment is made to the corresponding right-of-use asset, or to profit or loss if the carrying amount of the right-of-use asset is fully written down.

### **(f) Inventories**

Inventories are measured at the lower of cost and net realisable value. The cost of inventories includes expenditure incurred in acquiring the inventories and other costs incurred in bringing them to their existing location and condition. Net realisable value is the estimated selling price in the ordinary course of business, less selling expenses.



### **(g) Impairment**

The carrying amounts of the Company's non-financial assets are reviewed at each reporting date to determine whether there is any indication of impairment. If any such indication exists, then the asset's recoverable amount is estimated.

The recoverable amount of an asset is the greater of its value in use and its fair value less costs to sell. Value in use is determined as the current replacement cost of an asset.

An impairment loss is recognised if the carrying amount of an asset exceeds its estimated recoverable amount. Impairment losses are recognised in profit or loss. Impairment losses recognised in prior periods are assessed at each reporting date for any indications that the loss has decreased or no longer exists. An impairment loss is reversed if there has been a change in the estimates used to determine the recoverable amount. An impairment loss is reversed only to the extent that would have been determined, net of depreciation or amortisation, if no impairment loss had been recognised.

### **(h) Employee benefits**

#### **(i) Defined contribution plans**

A defined contribution plan is a post-employment benefit plan under which an entity pays fixed contributions into a separate entity and will have no legal or constructive obligation to pay further amounts. Obligations for contributions to defined contribution plans are recognised as an employee benefit expense in profit or loss in the periods during which services are rendered by employees.

#### **(ii) Other long-term employee benefits**

The Company's net obligation in respect of long-term employee benefits is the amount of future benefit that employees have earned in return for their service in the current and prior periods plus related on-costs. The liability is measured such that it is not materially different from the estimate determined by discounting using market yields at the reporting date on corporate bonds with terms to maturity and currencies that match, as closely as possible, the estimated future cash outflows.

#### **(iii) Termination benefits**

Termination benefits are recognised as an expense when the Company is demonstrably committed, without realistic probability of withdrawal, to a formal detailed plan to either terminate employment before the normal retirement date, or to provide termination benefits as a result of an offer made to encourage voluntary redundancy. Termination benefits for voluntary redundancies are recognised as an expense if the Company has made an offer of voluntary redundancy, it is probable that the offer will be accepted, and the number of acceptances can be estimated reliably. If benefits are payable more than 12 months after the reporting period, then they are discounted to their present value.

#### **(iv) Short-term benefits**

Short-term employee benefit obligations are measured on an undiscounted basis and are expensed as the related service is provided.

A liability is recognised for the amount expected to be paid under short-term bonus plans if the Company has a present legal or constructive obligation to pay this amount as a result of past service provided by the employee and the obligation can be measured reliably. Such liabilities represent the best estimate of the amounts required to settle the obligation at the end of the reporting period.

### **(i) Revenue recognition**

The Company recognises revenue as follows:

#### **(i) Revenue from contracts with customers**

Revenue is recognised at an amount that reflects the consideration to which the Company is expected to be entitled in exchange for transferring goods or services to a customer. For each contract with a customer, the Company: identifies the contract with a customer; identifies the performance obligations in the contract; determines the transaction price which takes into account estimates of variable consideration and the time value of money; allocates the transaction price to the separate performance obligations on the basis of the relative stand-alone selling price of each distinct good or service to be delivered; and recognises revenue when or as each performance obligation is satisfied in a manner that depicts the transfer to the customer of the goods or services promised.

#### **(ii) Donations**

Donations are assessed to determine whether they carry sufficiently specific performance obligations and meet other criteria for recognition in accordance with AASB 15 *Revenue from Contracts with Customers*, where this is not the case donations are recognised on receipt in accordance with AASB 1058 *Income of Not-for-Profit Entities*.

#### **(iii) Grants**

Grant revenue is recognised in profit or loss when the Company satisfies the performance obligations stated within the funding agreements.

If conditions are attached to the grant which must be satisfied before the Company is eligible to retain the contribution, the grant will be recognised in the statement of financial position as a liability until those conditions are satisfied.

#### **(iv) Finance income**

Finance income comprises interest income and dividends. Interest income is recognised as it accrues in profit or loss using the effective interest rate method. Dividend income is recognised in profit or loss on the date on which the Company's right to receive payment is established.

#### **(v) Other revenue**

Other revenue is recognised when it is received or when the right to receive payment is established.

### **(j) Goods and services tax**

Revenue, expenses and assets are recognised net of the amount of goods and services tax (GST), except where the amount of GST incurred is not recoverable from the taxation authority. In these circumstances, the GST is recognised as part of the cost of acquisition of the asset or as part of the expense.

Receivables and payables are stated with the amount of GST included. The net amount of GST recoverable from, or payable to, the ATO is included as a current asset or current liability in the statement of financial position.

Cash flows are included in the statement of cash flows on a gross basis. The GST components of the cash flows arising from investing and financing activities which are recoverable from, or payable to, the ATO are classified as operating cash flows.

### **(k) Trade and other receivables**

Trade receivables are initially recognised at fair value and subsequently measured at amortised cost using the effective interest method, less any allowance for expected credit losses. Trade receivables are generally due for settlement within 30 days.

The Company has applied the simplified approach to measuring expected credit losses, which uses a lifetime expected loss allowance. To measure the expected credit losses, trade receivables have been grouped based on days overdue. Other receivables are recognised at amortised cost, less any allowance for expected credit losses.

#### (I) Right of use assets

A right of use asset is recognised at the commencement date of a lease. The right of use asset is measured at cost, which comprises the initial amount of the lease liability, adjusted for, as applicable, any lease payments made at or before the commencement date net of any lease incentives received, any initial direct costs incurred, and, except where included in the cost of inventories, an estimate of costs expected to be incurred for dismantling and removing the underlying asset, and restoring the site or asset.

Right of use assets are depreciated on a straight-line basis over the unexpired period of the lease or the estimated useful life of the asset, whichever is the shorter. Where the Company expects to obtain ownership of the leased asset at the end of the lease term, the depreciation is over its estimated useful life. Right of use assets are subject to impairment or adjusted for any remeasurement of lease liabilities.

The Company has elected not to recognise a right of use asset and corresponding lease liability for short-term leases with terms of 12 months or less and leases of low-value assets. Lease payments on these assets are expensed to profit or loss as incurred.

## 2. Other income

	2023	2022
Net gain/(loss) on sale of property, plant and equipment	–	15,925
Reimbursement received relating to prior period occupancy costs	–	172,105
	–	188,030

## 3. Personnel expenses

	2023	2022
Wages and salaries	9,806,053	9,715,681
Other associated personnel expenses	391,482	644,558
Contributions to defined contribution plans	1,043,273	972,481
	11,240,808	11,332,720

## 4. Cash and cash equivalents

	2023	2022
Cash on hand	237	229
Bank deposits at-call	1,226,963	3,430,772
Cash and cash equivalents in the statement of cash flows	1,227,200	3,431,001

## 5. Trade and other receivables

	2023	2022
Trade receivables due from those other than related parties	736,945	810,584
Trade receivables due from related parties	–	106,942
Other receivables	1,182,327	857,783
	1,919,272	1,775,309

Trade receivables are shown net of expected credit losses amounting to \$26,153 (2022: \$28,140) at reporting date. This allowance account is used to record expected credit losses until the Company is satisfied that no recovery of the amount owing is possible; at that point the amounts are considered irrecoverable and are written off against the financial asset directly.

The movement in the allowance for expected credit losses in respect of trade receivables during the year was as follows:

	2023	2022
Balance at 1 July	28,140	30,852
Payments received in relation to previous expected credit loss balances	(86)	(2,667)
Expected credit loss for the year	(486)	(45)
Written off during the year	(1,415)	–
Balance at 30 June	26,153	28,140

## 6. Inventories

	2023	2022
Course materials on hand - wine	74,336	87,480
Contingency supply of laboratory consumables	–	5,000
	74,336	92,480

## 7. Other investments

	2023	2022
<b>Non-current</b>		
Financial assets at fair value through OCI, comprising listed investments at fair value in:		
Interest rate securities	4,780,360	4,958,092
Equity securities	4,248,710	4,859,478
	9,029,070	9,817,570

All equity securities and interest rate securities are quoted on the Australian Securities Exchange. Interest rate securities include corporate bonds, subordinated notes and convertible and reset preference securities. Equity securities include direct shareholdings, exchange traded funds and managed funds.

## 8. Property, plant and equipment

	Plant and machinery	Office furniture and IT	Laboratory equipment	Capital work in progress	Total
<b>Cost</b>					
Balance at 1 July 2022	681,587	1,120,623	13,812,632	72,900	15,687,742
Additions	60,095	66,991	915,027	5,729	1,047,842
Transfers	–	–	69,291	(78,629)	(9,338)
Disposals	–	(3,778)	(806,755)	–	(810,533)
Balance at 30 June 2023	741,682	1,183,836	13,990,195	–	15,915,713
<b>Depreciation and impairment losses</b>					
Balance at 1 July 2022	591,576	834,903	10,148,138	–	11,574,617
Depreciation charge for the year	25,823	118,652	954,185	–	1,098,660
Transfers	–	–	–	–	–
Disposals	–	(3,778)	(806,755)	–	(810,533)
Balance at 30 June 2023	617,399	949,777	10,295,568	–	11,862,744
<b>Carrying amounts</b>					
at 1 July 2022	90,011	285,720	3,664,494	72,900	4,113,125
at 30 June 2023	124,283	234,059	3,694,627	–	4,052,969

## 9. Intangible assets

	Computer software	Intangible assets under development	Total
<b>Cost</b>			
Balance at 1 July 2022	902,249	331,077	1,233,326
Additions	100,234	65,575	165,809
Transfers	197,718	(188,381)	9,338
Disposals	–	–	–
Balance at 30 June 2023	1,200,201	208,272	1,408,473
<b>Amortisation and impairment losses</b>			
Balance at 1 July 2022	727,195	–	727,195
Amortisation charge for the year	76,475	–	76,475
Transfers	–	–	–
Disposals	–	–	–
Balance at 30 June 2023	803,670	–	803,670
<b>Carrying amounts</b>			
at 1 July 2022	175,054	331,077	506,131
at 30 June 2023	396,531	208,272	604,803

### Computer software

Computer software assets are recognised as the attributable software licence and development costs paid to third parties, and do not include employee costs or an attribution of relevant overheads, as only an immaterial component of software development and testing processes are performed in-house. These software assets are

amortised over periods of between three and five years, based upon their estimated useful lives and expected technical obsolescence.

Intangible assets under development at 30 June 2023 represent expenditure towards the development of computer software which as of that date is not classified as ready for use.



## 10. Right of use assets

	2023	2022
<b>Buildings (WIC) – right of use</b>		
<b>Cost</b>		
Balance at 1 July	6,100,140	6,100,140
Balance at 30 June	6,100,140	6,100,140
<b>Depreciation and impairment losses</b>		
Balance at 1 July	2,764,217	2,560,879
Depreciation charge for the year	203,339	203,338
Balance at 30 June	2,967,556	2,764,217
<b>Carrying amount</b>	<b>3,132,584</b>	<b>3,335,923</b>

### Interest in WIC building

The Company has a 50-year nominal occupancy right to approximately 53% of the space in the Wine Innovation Cluster (WIC) Central building owned by the University of Adelaide. The other occupants are currently the University of Adelaide and Fight Food Waste Cooperative Research Centre. The term of occupancy is reviewable after 30 years based on the remaining economic life of the building. The value assigned to the AWRI's interest in the building is net of amounts contributed by Wine Australia (WA). The building cost is being depreciated over a period of 30 years from the date of practical completion (26 November 2008).

## 11. Payables and accruals

	2023	2022
<b>Current</b>		
Trade payables due to those other than related parties	413,859	471,272
Trade payables due to related parties	–	–
PAYG and GST	346,877	458,085
Non-trade payables and accrued expenses	1,211,669	1,329,864
	<b>1,972,405</b>	<b>2,259,221</b>

## 12. Contract liability

Any unexpended WA funding is reimbursable to WA, except where WA agrees that amounts can be retained by the AWRI for purposes approved by WA, at which point such amounts are considered to be committed towards that purpose.

The unexpended investment agreement funds for the current year totalled \$37,643 (2022: \$248,662). During the year no unspent prior years' funds relating to WA projects were returned to WA (2022: NIL).

There were no unexpended funds from other WA contracts for the current year (2022: NIL).

	2023	2022
<b>Unexpended funds carried forward to satisfy future performance obligations</b>		
WA current year's investment agreement funding unexpended	37,643	248,662
WA current year's other contract funding unexpended	–	–
WA prior years' funding unexpended	248,662	–
	<b>286,305</b>	<b>248,662</b>
<b>Income received in advance</b>	<b>1,044,458</b>	<b>3,165,096</b>
	<b>1,330,763</b>	<b>3,413,758</b>

## 13. Provisions

	2023	2022
<b>Current</b>		
Employee entitlements	1,933,656	1,923,465
<b>Non-current</b>		
Employee entitlements	241,527	298,470
Number of employees (full-time equivalents)	103.5	106.3

## 14. Operating leases

### Leases as lessee

Non-cancellable operating lease rentals are payable as follows:

	2023	2022
Within one year	3,432	3,432
One year or later and no later than five years	7,722	11,154
Later than five years	–	–
	<b>11,154</b>	<b>14,586</b>

The Company's operating leases are not considered to be material and the reported rental expenses are those at face value rather than as measured under AASB 16 Leases. These leases provide no option to renew or purchase at the completion of its term.

During the year ended 30 June 2023 an amount of \$3,432 was recognised as an expense in respect of operating leases (2022: \$3,432).

### Leases as lessor

The Company leases out part of its interest in the WIC Central building (refer note 10) to the Australian Wine Industry Technical Conference Incorporated. Associated lease payments are included within the transactions with related parties disclosed within note 17. The future minimum lease payments under non-cancellable leases are receivable as follows:

	2023	2022
Within one year	8,000	8,000
One year or later and no later than five years	17,333	25,333
Later than five years	–	–
	<b>25,333</b>	<b>33,333</b>

During the year ended 30 June 2023 an amount of \$8,892 was recognised as rental income (2022: \$8,892). This amount exceeds the minimum lease payments disclosed above due to lease payments being subject to annual adjustment over the term of the lease with reference to an inflation-based index.

## 15. Capital commitments

	2023	2022
<b>Property, plant and equipment</b>		
<i>Contracted but not provided for and payable</i>		
Within one year	8,495	20,931
One year or later and no later than five years	–	–
Later than five years	–	–
	8,495	20,931
<b>Computer software development</b>		
<i>Contracted but not provided for and payable</i>		
Within one year	37,708	80,914
One year or later and no later than five years	–	–
Later than five years	–	–
	37,708	80,914

## 16. Research funding commitments

	2023	2022
<i>Contracted but not provided for and payable</i>		
Within one year	155,880	290,880
One year or later and no later than five years	208,426	364,306
Later than five years	–	–
	364,306	655,186

## 17. Related parties

### Key management personnel compensation

Key management personnel comprises the Directors of the Company and other persons having authority and responsibility for planning, directing and controlling the activities of the Company. Key management personnel compensation comprised:

	2023	2022
Total remuneration	1,691,558	2,024,887

During the year non-executive Directors became entitled to compensation totalling \$91,569 (2022: \$93,249). A number of Directors voluntarily elected not to receive \$52,500 of this entitlement (2022: \$61,750), instead redirecting such amounts to support otherwise unfunded activities of the Company including individual and group professional development for AWRI staff, and the provision of support to visiting scientists.

### Key management personnel and Director transactions

A number of key management personnel, or their related parties, hold positions in other entities that result in them having control or significant influence over the financial or operating policies of these entities.

A number of these entities transacted with the Company in the reporting period. The terms and conditions of the transactions

with key management personnel and their related parties were no more favourable than those available, or which might reasonably be expected to be available, on similar transactions to non-key management personnel related entities on an arm's length basis.

Related parties arising through relationships with key management personnel:

Clonakilla Wines  
Oenologie Requin Pty Ltd (trading as Bekkers Wine)  
Oliver's Taranga Vineyards  
Swell Brewing Co.  
Vitibit Pty Ltd

### Other related party transactions

During the year the Company provided administrative services and leased office premises to a jointly controlled entity, The Australian Wine Industry Technical Conference Incorporated.

Other related parties:

The Australian Wine Industry Technical Conference Incorporated

### Transactions with related parties

	Transactions value for the year ended 30 June		Balance outstanding as at 30 June	
	2023	2022	2023	2022
Services received from related parties	3,741	60,445	–	–
Services provided to related parties	2,375	270,879	95	106,942

## 18. Auditor remuneration

During the year the following fees were paid or payable for services provided by accounting firm BDO Audit (SA) Pty Ltd, the auditor of the Company, and its network firms:

	2023	2022
Audit of the financial report	25,000	23,531
<i>Other services:</i>		
Preparation and lodgement of fringe benefits tax return	1,743	2,127
	26,743	25,658

## 19. Contingencies

In the opinion of the Directors, there were no material or significant contingent liabilities at 30 June 2023 (2022: none).

## 20. Subsequent events

There has not arisen in the interval between the end of the financial year and the date of this report any item, transaction or event of a material and unusual nature likely to significantly affect the operations of the Company, the results of those operations, or the state of affairs of the Company, in subsequent financial years.

## 21. Limited liability

In accordance with the Company's constitution, each member (both during the time he or she is a member and within one year afterwards) is liable to contribute \$2 in the event that the Company is wound up. The total amount members would contribute is \$20 (2022: \$20).

## Responsible persons' declaration

The Directors of The Australian Wine Research Institute Limited (the Company) declare that, in the Directors' opinion:

- (a) the financial statements, comprising the statement of profit or loss and other comprehensive income, statement of financial position, statement of cash flows, statement of changes in equity, and accompanying notes, are in accordance with the *Australian Charities and Not-for-profits Commission Act 2012* and:
  - (i) comply with Australian Accounting Standards – Simplified Disclosures and the *Australian Charities and Not-for-profits Commission Regulation 2022*; and
  - (ii) give a true and fair view of the entity's financial position as at 30 June 2023 and of its performance for the year ended on that date; and
- (b) there are reasonable grounds to believe that the Company will be able to pay all of its debts, as and when they become due and payable.

Signed in accordance with subsection 60.15(2) of the *Australian Charities and Not-for-profits Commission Regulation 2022*.



**Kieran D. Kirk**  
Chair



**Mark P. Krstic**  
Managing Director

Dated at Urrbrae on this the 19<sup>th</sup> day of September 2023.



# Independent auditor's report to the members of The Australian Wine Research Institute Limited

## Report on the Audit of the Financial Report

### Opinion

We have audited the financial report of The Australian Wine Research Institute Limited (the registered entity), which comprises the statement of financial position as at 30 June 2023, the statement of profit or loss and other comprehensive income, the statement of changes in equity and the statement of cash flows for the year then ended, and notes to the financial report, including a summary of significant accounting policies, and the responsible entities' declaration.

In our opinion the accompanying financial report of The Australian Wine Research Institute Limited, is in accordance with Division 60 of the *Australian Charities and Not-for-profits Commission Act 2012*, including:

- (i) Giving a true and fair view of the registered entity's financial position as at 30 June 2023 and of its financial performance for the year then ended; and
- (ii) Complying with Australian Accounting Standards – Simplified Disclosures and Division 60 of the *Australian Charities and Not-for-profits Commission Regulation 2022*.

### Basis for opinion

We conducted our audit in accordance with Australian Auditing Standards. Our responsibilities under those standards are further described in the *Auditor's responsibilities for the audit of the Financial Report* section of our report. We are independent of the registered entity in accordance with the auditor independence requirements of the *Australian Charities and Not-for-profits Commission Act 2012* (ACNC Act) and the ethical requirements of the Accounting Professional and Ethical Standards Board's APES 110 *Code of Ethics for Professional Accountants (including Independence Standards)* (the Code) that are relevant to our audit of the financial report in Australia. We have also fulfilled our other ethical responsibilities in accordance with the Code.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

### Other information

The responsible entities of the registered entity are responsible for the other information. The other information obtained at the date of this auditor's report is information included in registered entity's annual report, but does not include the financial report and our auditor's report thereon.

Our opinion on the financial report does not cover the other information and accordingly we do not express any form of assurance conclusion thereon.

In connection with our audit of the financial report, our responsibility is to read the other information and, in doing so, consider whether the other information is materially inconsistent with the financial report or our knowledge obtained in the audit or otherwise appears to be materially misstated.

If, based on the work we have performed on the other information obtained prior to the date of this auditor's report, we conclude that there is a material misstatement of this other information, we are required to report that fact. We have nothing to report in this regard.

## Responsibilities of responsible entities for the Financial Report

The responsible entities of the registered entity are responsible for the preparation and fair presentation of the financial report in accordance with Australian Accounting Standards – Simplified Disclosures and the ACNC Act, and for such internal control as the responsible entities determine is necessary to enable the preparation of the financial report that is free from material misstatement, whether due to fraud or error.

In preparing the financial report, responsible entities are responsible for assessing the registered entity's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless the responsible entities either intends to liquidate the registered entity or to cease operations, or has no realistic alternative but to do so.

The responsible entities of the registered entity are responsible for overseeing the registered entity's financial reporting process.

## Auditor's responsibilities for the audit of the Financial Report

Our objectives are to obtain reasonable assurance about whether the financial report as a whole is free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with the Australian Auditing Standards will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of this financial report.

A further description of our responsibilities for the audit of the financial report is located at the Auditing and Assurance Standards Board website (<http://www.auasb.gov.au/Home.aspx>) at: [http://www.auasb.gov.au/auditors\\_responsibilities/ar4.pdf](http://www.auasb.gov.au/auditors_responsibilities/ar4.pdf)

This description forms part of our auditor's report.



BDO Audit Pty Ltd



Josh Carver

Director

Adelaide, 29 September 2023

# Memorial funds

Consisting of (and collectively the "Trusts"):

The John Fornachon Memorial Library Endowment Fund

The Thomas Walter Hardy Memorial Trust Fund

The H. R. Haselgrove Memorial Trust Fund

The Stephen Hickinbotham Memorial Research Trust

## Statement by Directors of the trustee company

The Australian Wine Research Institute Limited (the "Trustee") acts as unrewarded trustee for the above listed Trusts. As detailed in note 2 to these financial statements, the Trusts are not reporting entities because, in the Trustee's opinion, it is unlikely that users exist who are unable to command the preparation of reports tailored so as to satisfy, specifically, all of their information needs. This is a special purpose financial report that has been prepared to meet the reporting obligations of the Trustee.

In the opinion of the Directors of The Australian Wine Research Institute Limited (the Trustee):

- (a) (i) the statements of profit or loss and other comprehensive income give a true and fair view of each Trust's profit or loss for the year ended 30 June 2023; and
- (ii) the statements of financial position give a true and fair view of each Trust's state of affairs as at 30 June 2023.
- (b) at the date of this statement, there are reasonable grounds to believe that the Trusts will be able to pay their debts as and when they fall due.

This statement is made in accordance with a resolution of the Directors of the trustee company and is signed for and on behalf of the Directors by:



**Kiaran D. Kirk**

Chair

Dated at Urrbrae on this the 19<sup>th</sup> day of September 2023.

## Notes to the financial statements

### 1. Nature and purpose of the Trusts

- (a) The John Fornachon Memorial Library Endowment Fund was established on 30 September 1970, to provide for the establishment and maintenance of the Fornachon Memorial Library, for the promotion of study and general knowledge of the wine industry. The Fund was established by way of public appeal on a memorial to the late John Charles Macleod Fornachon, the Director of Research of The Australian Wine Research Institute Limited from 1955 to 1968.
- (b) The Thomas Walter Hardy Memorial Trust Fund was established on 29 June 1993 to assist in the communication of information within the wine industry and associated activities, allied to the wine industry on behalf of the Trust. The Trust was established in memory of the late Thomas Walter Hardy.
- (c) The H.R. Haselgrove Memorial Trust Fund was established on 12 December 1979 to provide for the promotion and encouragement of wine research by, or under the direction of, The Australian Wine Research Institute Limited as a memorial to the late Harry Ronald Haselgrove.
- (d) The Stephen Hickinbotham Memorial Research Trust was established on 7 October 1986 to provide financial assistance and support in the pursuit of scientific research and associated activities, allied to the wine industry. The Trust was established in memory of the late Stephen John Hickinbotham. The Australian Wine Research Institute Limited assumed responsibility for the Trust on 25 May 1992.

### 2. Statement of accounting policies

In the opinion of the Trustee, the Trusts are of a type identified in Statement of Accounting Concepts 1 as non-reporting entities. Accordingly, the financial statements constitute 'special purpose financial reports' which have been prepared solely to meet the reporting obligations of the Trustee, and the limited information needs of the Trusts' members.

The financial statements have been prepared in accordance with accounting standards, except as stated below, and other mandatory professional reporting requirements.

The following accounting standards have not been adopted because, in the opinion of the Trustee, the cost of compliance outweighs the benefit of the resultant information:

- AASB 7 Financial Instruments: Disclosures
- AASB 107 Statement of Cash Flows
- AASB 124 Related Party Disclosures
- AASB 132 Financial Instruments: Presentation

The financial statements have been prepared on an accrual basis.

Accounting policies have been consistently applied, with the only significant policy being in relation to investments.

Investments consist of interest rate securities and exchange traded funds, all of which are quoted on the Australian Securities Exchange and recorded at fair value through other comprehensive income. Investment income is brought to account as earned, with accrued earnings at balance date being included in the statement of financial position as receivables.

# Statements of profit or loss and other comprehensive income

For the year ended 30 June 2023

	The John Fornachon Memorial Library Endowment Fund		The Thomas Walter Hardy Memorial Trust Fund		The H.R. Haselgrove Memorial Trust Fund		The Stephen Hickinbotham Memorial Research Trust	
	2023	2022	2023	2022	2023	2022	2023	2022
<b>Income</b>								
Investments	8,085	5,260	4,515	3,831	5,542	4,182	6,066	4,856
Donations and other income	–	–	–	–	–	–	–	–
Total income	8,085	5,260	4,515	3,831	5,542	4,182	6,066	4,856
<b>Expenses</b>								
Investment management expenses	513	647	419	509	434	533	462	568
Sponsorship of 18 <sup>th</sup> Australian Wine Industry Technical Conference	–	–	–	10,000	–	–	–	7,000
Total expenses	513	647	419	10,509	434	533	462	7,568
<b>Profit/(loss) from ordinary activities</b>	7,572	4,613	4,096	(6,678)	5,109	3,649	5,604	(2,712)
<b>Other comprehensive income</b>								
Items that will not be reclassified subsequently to profit or loss:								
Gain/(loss) on revaluation of financial assets at fair value through other comprehensive income	5,374	(9,398)	3,564	(6,369)	3,823	(7,278)	4,320	(8,140)
<b>Total comprehensive income for the period</b>	12,946	(4,785)	7,660	(13,047)	8,931	(3,629)	9,924	(10,852)



# Statements of financial position

As at 30 June 2023

	The John Fornachon Memorial Library Endowment Fund		The Thomas Walter Hardy Memorial Trust Fund		The H.R. Haselgrove Memorial Trust Fund		The Stephen Hickinbotham Memorial Research Trust	
	2023	2022	2023	2022	2023	2022	2023	2022
<b>Assets</b>								
Cash at bank	6,327	7,238	7,059	4,523	4,648	4,251	4,313	5,626
Investments	–	–	–	–	–	–	–	–
Receivables	2,240	2,194	970	1,341	1,514	2,256	1,677	1,710
<b>Total current assets</b>	<b>8,567</b>	<b>9,432</b>	<b>8,028</b>	<b>5,864</b>	<b>6,161</b>	<b>6,507</b>	<b>5,990</b>	<b>7,336</b>
Investments	148,933	135,122	82,965	87,470	102,900	93,623	110,009	105,739
<b>Total non-current assets</b>	<b>148,933</b>	<b>135,122</b>	<b>82,965</b>	<b>87,470</b>	<b>102,900</b>	<b>93,623</b>	<b>110,009</b>	<b>105,739</b>
<b>Total assets</b>	<b>157,500</b>	<b>144,554</b>	<b>90,994</b>	<b>93,334</b>	<b>109,061</b>	<b>100,130</b>	<b>115,999</b>	<b>113,075</b>
<b>Liabilities</b>								
Committed funding contribution	–	–	–	10,000	–	–	–	7,000
<b>Total current liabilities</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>10,000</b>	<b>–</b>	<b>–</b>	<b>–</b>	<b>7,000</b>
<b>Net assets</b>	<b>157,500</b>	<b>144,554</b>	<b>90,994</b>	<b>83,334</b>	<b>109,061</b>	<b>100,130</b>	<b>115,999</b>	<b>106,075</b>
<b>Trust funds</b>								
Settled sum	12,785	12,785	50	50	20,000	20,000	50	50
Founders donation	–	–	25,000	25,000	–	–	–	–
	12,785	12,785	25,050	25,050	20,000	20,000	50	50
<b>Accumulated surplus</b>								
Opening balance	129,107	124,298	56,819	63,889	78,605	75,371	104,011	107,337
Profit/(loss) for the year	7,572	4,613	4,096	(6,678)	5,109	3,649	5,604	(2,712)
Transfers to/(from) accumulated surplus	(483)	196	(2,392)	(392)	(332)	(415)	(373)	(614)
Closing balance	136,196	129,107	58,523	56,819	83,382	78,605	109,241	104,011
<b>Financial assets at fair value through other comprehensive income reserve</b>								
Opening balance	2,662	12,256	1,465	7,442	1,525	8,388	2,014	9,539
Gain/(loss) on revaluation of financial assets at fair value through other comprehensive income	5,374	(9,398)	3,564	(6,369)	3,823	(7,278)	4,320	(8,140)
Transfers to/(from) reserve	483	(196)	2,392	392	332	415	373	614
Closing balance	8,519	2,662	7,421	1,465	5,679	1,525	6,708	2,014
<b>Total trust funds</b>	<b>157,500</b>	<b>144,554</b>	<b>90,994</b>	<b>83,334</b>	<b>109,061</b>	<b>100,130</b>	<b>115,999</b>	<b>106,075</b>

## APPENDIX 1

# External presentations

Staff	Title of presentation	Presented to and where	Date
T.E. Siebert	Struck flint aroma in Chardonnay wines	IVAS conference, Neustadt, Germany	7 Jul 2022
C.A. Simos	Wine taints and faults	Solotel Hotels Group, Sydney, NSW	12 Jul 2022
R. Dixon	Online non-chemical weed control tool and cover crop selector	Climate change adaptation: Building resilience in the vineyard workshop, Ararat, VIC	
		Climate change adaptation: Building resilience in the vineyard workshop, Yarra Valley, VIC	14 Jul 2022
M.L. Longbottom	Introduction	Sustainable Winegrowing Australia workshop (with regional update), Yarra Valley, VIC	
	Sustainability: global insights		
L.M. Pitcher	Sustainability performance and targets in Yarra Valley		
R. Dixon	Online non-chemical weed control tool and cover crop selector	Climate change adaptation: Building resilience in the vineyard workshop, Mornington Peninsula, VIC	15 Jul 2022
W.P. Pearson	The regional story of cool and warm climate Australian Shiraz: sensory and chemical profiles of wines from six different regions	International Cool Climate Wine Symposium, Toronto, Canada	18 Jul 2022
	Art of wine science		19 Jul 2022
S.R. Barter	Mapping the complex patterns of pepper flavour in Australian Shiraz		
W.P. Pearson	Canadian Cabernet Franc panel tasting		
L.M. Pitcher	Sustainability: global insights and introduction	Australian Wine Industry Standard of Sustainable Practice (AWISSP) certification training, Adelaide, SA	22 Jul 2022
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
M.L. Longbottom	Internal audits		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals	AWISSP certification training, Adelaide, SA	
M.L. Longbottom	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
M.L. Longbottom	Biodiversity		
L.M. Pitcher	Waste		
	Air quality		
M.L. Longbottom	Energy and fuel		
L.M. Pitcher	Scope and commitment to sustainability		
	Documentation		
M.L. Longbottom	Training and development		
L.M. Pitcher	Suppliers		
	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		

Staff	Title of presentation	Presented to and where	Date
L.M. Pitcher	Winery product identification, traceability, withdrawal and recall requirements	AWISSP certification training, Adelaide, SA	22 Jul 2022
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
M.L. Longbottom	Sustainability: global insights and introduction	AWISSP certification training, Margaret River, WA	2 Aug 2022
	Introduction to Sustainable Winegrowing Australia certification		
L.M. Pitcher	Property maps		
M.L. Longbottom	Internal audits		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals		
M.L. Longbottom	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
M.L. Longbottom	Biodiversity		
L.M. Pitcher	Waste		
	Air quality		
	Energy and fuel		
	Scope and commitment to sustainability		
	Documentation		
	Training and development		
	Suppliers		
	Customer and regulatory requirements		
M.L. Longbottom	Incident management, corrective and preventative actions, management review		3 Aug 2022
	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
	Sustainability: global insights and introduction		
	Introduction to Sustainable Winegrowing Australia certification		
L.M. Pitcher	Property maps		
M.L. Longbottom	Internal audits		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals		
M.L. Longbottom	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
M.L. Longbottom	Biodiversity		
L.M. Pitcher	Waste		
	Air quality		
M.L. Longbottom	Energy and fuel		



Staff	Title of presentation	Presented to and where	Date
L.M. Pitcher	Scope and commitment to sustainability	AWISSP certification training, Margaret River, WA	3 Aug 2022
	Documentation		
	Training and development		
	Suppliers		
	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
M.Z. Bekker	The science of volatiles: how to taste with your nose	Science in the Pub, The Rob Roy Hotel, Adelaide, SA	5 Aug 2022
M.L. Longbottom	Sustainability: global insights and introduction	AWISSP certification training (virtual)	9 Aug 2022
	Introduction to Sustainable Winegrowing Australia certification		
C.M. Brodie	Property maps		
M.L. Longbottom	Internal audits		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
C.M. Brodie	Pest and disease management in vineyards and winery chemicals		
M.L. Longbottom	Land, soil and nutrient management		
C.M. Brodie	Water and wastewater		
M.L. Longbottom	Biodiversity		11 Aug 2022
C.M. Brodie	Waste		
	Air quality		
M.L. Longbottom	Energy and fuel		
C.M. Brodie	Scope and commitment to sustainability		
M.L. Longbottom	Documentation		
	Training and development		
C.M. Brodie	Suppliers		
	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		
M.L. Longbottom	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
M.G. Holdstock	Faults and taints	Melbourne Polytechnic/La Trobe University students (virtual)	
M.L. Longbottom	Sustainable Winegrowing Australia update	AWRI webinar	
D. Espinase Nandorfy	Wine sensory science	University of Queensland School of Psychology and Neuroscience wine tasting club (virtual)	18 Aug 2022
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training, Adelaide, SA	26 Aug 2022
	Introduction to Sustainable Winegrowing Australia certification		

Staff	Title of presentation	Presented to and where	Date
L.M. Pitcher	Property maps	AWISSP certification training, Adelaide, SA	26 Aug 2022
C.M. Brodie	Internal audits		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals		
C.M. Brodie	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
C.M. Brodie	Biodiversity		
L.M. Pitcher	Waste		
	Air quality		
C.M. Brodie	Energy and fuel		
L.M. Pitcher	Scope and commitment to sustainability		
	Documentation		
C.M. Brodie	Training and development		
L.M. Pitcher	Suppliers		
	Customer and regulatory requirements		
C.M. Brodie	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
L.M. Pitcher	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
M.L. Longbottom	Sustainability: global insights and introduction	AWISSP certification training, Limestone Coast, SA	30 Aug 2022
	Introduction to Sustainable Winegrowing Australia certification		
C.M. Brodie	Property maps		
M.L. Longbottom	Internal audits		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
C.M. Brodie	Pest and disease management in vineyards and winery chemicals		
M.L. Longbottom	Land, soil and nutrient management		
C.M. Brodie	Water and wastewater		
M.L. Longbottom	Biodiversity		
C.M. Brodie	Waste		
	Air quality		
M.L. Longbottom	Energy and fuel		
C.M. Brodie	Scope and commitment to sustainability		
M.L. Longbottom	Documentation		
	Training and development		
C.M. Brodie	Suppliers		
	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		

Staff	Title of presentation	Presented to and where	Date	
M.L. Longbottom	Winery product identification, traceability, withdrawal and recall requirements	AWISSP certification training, Limestone Coast, SA	30 Aug 2022	
	Sustainable Winegrowing Australia trust mark use			
	Audit preparation and subsequent actions			
M.G. Holdstock	Nitrogen: from vineyard to winery	Spring vine health field day, Hunter Valley, NSW (virtual)	1 Sep 2022	
M.R. Solomon	Influencing tropical thiol concentration in white wine by combining foliar sprays and yeast selection	AWRI webinar		
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training (virtual)	5 Sep 2022	
	Introduction to Sustainable Winegrowing Australia certification			
	Property maps			
C.M. Brodie	Internal audits			7 Sep 2022
	Sustainability action planning and benchmarking reports			
	Biosecurity			
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals			
C.M. Brodie	Land, soil and nutrient management			
L.M. Pitcher	Water and wastewater			
C.M. Brodie	Biodiversity			
L.M. Pitcher	Waste			
	Air quality			
C.M. Brodie	Energy and fuel			
L.M. Pitcher	Scope and commitment to sustainability			
	Documentation			
C.M. Brodie	Training and development			
L.M. Pitcher	Suppliers			
	Customer and regulatory requirements			
C.M. Brodie	Incident management, corrective and preventative actions, management review			
	Winery product identification, traceability, withdrawal and recall requirements			
L.M. Pitcher	Sustainable Winegrowing Australia trust mark use			
	Audit preparation and subsequent actions			
D. Espinase Nandorfy	Life after PhD (during an industry PhD)	Deakin University School of Exercise and Nutrition Sciences, VIC (virtual)	8 Sep 2022	
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training, Clare, SA		
	Introduction to Sustainable Winegrowing Australia certification			
	Property maps			
C.M. Brodie	Internal audits			
	Sustainability action planning and benchmarking reports			
	Biosecurity			
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals			
C.M. Brodie	Land, soil and nutrient management			



Staff	Title of presentation	Presented to and where	Date
L.M. Pitcher	Water and wastewater	AWISSP certification training, Clare, SA	8 Sep 2022
C.M. Brodie	Biodiversity		
L.M. Pitcher	Waste		
	Air quality		
C.M. Brodie	Energy and fuel		
L.M. Pitcher	Scope and commitment to sustainability		
	Documentation		
C.M. Brodie	Training and development		
L.M. Pitcher	Suppliers		
	Customer and regulatory requirements		
C.M. Brodie	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
L.M. Pitcher	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
M.L. Longbottom	Sustainability: global insights and introduction	AWISSP certification training, Adelaide, SA	9 Sep 2022
	Introduction to Sustainable Winegrowing Australia certification		
C.M. Brodie	Property maps		
M.L. Longbottom	Internal audits		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
C.M. Brodie	Pest and disease management in vineyards and winery chemicals		
M.L. Longbottom	Land, soil and nutrient management		
C.M. Brodie	Water and wastewater		
M.L. Longbottom	Biodiversity		
C.M. Brodie	Waste		
	Air quality		
M.L. Longbottom	Energy and fuel		
C.M. Brodie	Scope and commitment to sustainability		
M.L. Longbottom	Documentation		
	Training and development		
C.M. Brodie	Suppliers		
	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		
M.L. Longbottom	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training (virtual)	13 Sep 2022
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		

Staff	Title of presentation	Presented to and where	Date
C.M. Brodie	Internal audits	AWISSP certification training (virtual)	13 Sep 2022
	Sustainability action planning and benchmarking reports		
	Biosecurity		
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals		15 Sep 2022
C.M. Brodie	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
C.M. Brodie	Biodiversity		
L.M. Pitcher	Waste		
	Air quality		
C.M. Brodie	Energy and fuel		
L.M. Pitcher	Scope and commitment to sustainability		
	Documentation		
C.M. Brodie	Training and development		
L.M. Pitcher	Suppliers		
	Customer and regulatory requirements		
C.M. Brodie	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
L.M. Pitcher	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
R. Dixon	Financial considerations of vineyard resting	Mothballing vineyards information session, Renmark, SA	19 Sep 2022
		Mothballing vineyards information session, Waikerie, SA	20 Sep 2022
		C.A. Simos	Mothballing vineyards information session, Langhorne Creek, SA
G.D. Cowey	<i>Brettanomyces</i> : management, testing and interpretation, remediation	ASVO oenology seminar, Adelaide, SA (virtual)	23 Sep 2022
K.A. Bindon	Using maceration techniques to tailor red wine styles	AWRI roadshow seminar, Clare Valley, SA	26 Sep 2022
M.Z. Bekker	Managing 'reductive' aromas in wine		
R. Dixon	Welcome and overview of extension projects		
	Organic vs conventional practices compared: what's stopping you from going organic?		
A.R. Borneman	Winemaking with non- <i>Saccharomyces</i> yeasts		
R. Gawel	White wine texture: the interactive effects of phenolics, polysaccharides, acidity and alcohol		
A.M. Mierczynska-Vasilev	Cold and protein stabilisation challenges and solutions	ASVO oenology seminar, Adelaide, SA (virtual)	28 Sep 2022
M.G. Holdstock	Welcome and overview of extension projects	AWRI roadshow seminar, McLaren Vale, SA	
M.L. Longbottom	How to improve fruit set in cool climates		
P.J. Costello	MLF research roundup: applications and insights from current research at the AWRI		
S. Nordestgaard, W.-H. Hsieh	Autonomous vineyard robots and tractors		
A.R. Borneman	Winemaking with non- <i>Saccharomyces</i> yeasts		

Staff	Title of presentation	Presented to and where	Date
S. Nordestgaard	Sensor options for monitoring ferments	AWRI roadshow seminar, McLaren Vale, SA	28 Sep 2022
D. Espinase Nandorfy	The influence of amino acids and their interactions on the sensory properties and consumer acceptance of dry red wine	AWRI webinar	29 Sep 2022
C.M. Brodie, L.M. Pitcher	Sustainable Winegrowing Australia certification workshop: follow-up	AWISSP certification training follow-up session (virtual)	11 Oct 2022
A.L. Robinson	Welcome and overview of the AWRI	Advanced Viticulture Course (AVC 3), Adelaide, SA	17 Oct 2022
L.M. Pitcher	Sustainable Winegrowing Australia		
A.R. Rinaldo	Virus testing		
A.R. Borneman	Genetics		
J.L. Hixson	Foliar sulfur and nitrogen applications		
S. Nordestgaard, W.-H. Hsieh	Autonomous vineyard robots and tractors		
M. Essling	Welcome and introduction to spray application	Spray application workshop, Hunter Valley, NSW	18 Oct 2022
L.M. Pitcher	Sustainable Winegrowing Australia certification workshop: follow-up	AWISSP certification training follow-up session (virtual)	
M.L. Longbottom	Sustainability in the Australian grape and wine sector	SW Agri Connect Trade Forum (virtual)	20 Oct 2022
	Sustainability: global insights and introduction	AWISSP certification training, Adelaide, SA	21 Oct 2022
	Introduction to Sustainable Winegrowing Australia certification		
L.M. Pitcher	Property maps		
M.L. Longbottom	Internal audits		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals		
M.L. Longbottom	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
M.L. Longbottom	Biodiversity		
L.M. Pitcher	Waste		
	Air quality		
M.L. Longbottom	Energy and fuel		
L.M. Pitcher	Scope and commitment to sustainability		
	Documentation		
M.L. Longbottom	Training and development		
L.M. Pitcher	Suppliers		
	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		
M.L. Longbottom	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
R. Dixon	Options for managing changing market conditions	Wine Grape Council of South Australia resting vineyards workshop, Langhorne Creek, SA	



Staff	Title of presentation	Presented to and where	Date
A.L. Robinson	Welcome and overview of the AWRI	Advanced Viticulture Course (AVC 4), Adelaide, SA	24 Oct 2022
M.L. Longbottom	Sustainable Winegrowing Australia		
A.R. Rinaldo	Virus testing		
A.R. Borneman	Genetics		
J.L. Hixson	Foliar sulfur and nitrogen applications		
S. Nordestgaard, W.-H. Hsieh	Autonomous vineyard robots and tractors		
L.M. Pitcher	Sustainable Winegrowing Australia certification workshop: follow-up	AWISSP certification training follow- up session (virtual)	25 Oct 2022
M.L. Longbottom	Sustainability in the Australian grape and wine sector	Clare Future Leaders, McLaren Vale, SA	
	Sustainable Winegrowing Australia update	Casella Management Group, McLaren Vale, SA	
	Sustainability: global insights and introduction	Introduction to sustainability workshop, Geelong, VIC	27 Oct 2022
	Sustainable Winegrowing Australia: Geelong		
	Sustainability case study: Lake Moodemere Estate		
	Sustainability case study: The Madgett's Block		
	Sustainability case study: Chandon		
	Sustainable Winegrowing Australia: getting started		
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training (virtual)	31 Oct 2022
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
C.M. Brodie	Internal audits		
	Sustainability action planning and benchmarking reports		
L.M. Pitcher	Biosecurity		
	Pest and disease management in vineyards and winery chemicals		
C.M. Brodie	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater	AWISSP certification training follow- up session (virtual)	1 Nov 2022
	Sustainable Winegrowing Australia certification workshop: follow-up		
C.M. Brodie	Biodiversity	AWISSP certification training (virtual)	2 Nov 2022
L.M. Pitcher	Waste		
	Air quality		
C.M. Brodie	Energy and fuel		
L.M. Pitcher	Scope and commitment to sustainability		
	Documentation		
C.M. Brodie	Training and development		
	Suppliers		
	Customer and regulatory requirements		
L.M. Pitcher	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		

Staff	Title of presentation	Presented to and where	Date
N. Scrimgeour	Affinity Labs regional brand launch	Barossa regional group, Tanunda, SA	2 Nov 2022
W.P. Pearson	No- and low-alcohol wines: insights and updates	AWRI webinar	3 Nov 2022
E.N. Wilkes	Smoke taint - global comparative ring test	Interwinery Analysis Group Annual General Meeting and Seminar, Adelaide, SA	4 Nov 2022
W.P. Pearson	What's happening in no- and low-alcohol wine?		
S. Nordestgaard	In-tank sensors for monitoring liquid level and fermentation		
M.L. Longbottom	Sustainability: global insights and introduction	Introduction to sustainability workshop, Wrattenbully, SA	8 Nov 2022
	Sustainable Winegrowing Australia: Limestone Coast		
C.M. Brodie	Sustainability case study: Lake Moodemere Estate		
	Sustainability case study: The Madgett's Block		
	Sustainability case study: Chandon		
M.L. Longbottom	Sustainable Winegrowing Australia: setting the vision for the Limestone Coast		
M.G. Holdstock	Welcome and introduction to services provided by the AWRI	AWRI roadshow seminar, Orange, NSW	
M.R. Solomon	Making tropical wine by vineyard foliar application of nitrogen and sulfur (virtual)		
C.M. Penfold	Weed management without synthetic chemicals		
	Cover cropping		
M. Essling	Scale and mealybug: what can I do to control these sap-sucking insects?		
M.G. Holdstock	Welcome and introduction to services provided by the AWRI	AWRI roadshow seminar, Southern Highlands, NSW	9 Nov 2022
M.R. Solomon	Making tropical wine by vineyard foliar application of nitrogen and sulfur (virtual)		
C.M. Penfold	Cover cropping		
M. Essling	Spray application: the basics		
M.L. Longbottom	Sustainable Winegrowing Australia: Barossa 2022 results	Barossa sustainability forum, Tanunda, SA	
C.A. Varela	Bioprotection in winemaking	AWRI webinar	10 Nov 2022
M.G. Holdstock	Welcome and introduction to services provided by the AWRI	AWRI roadshow seminar, Canberra, ACT	
M.R. Solomon	Making tropical wine by vineyard foliar application of nitrogen and sulfur		
C.M. Penfold	Weed management without synthetic chemicals		
M. Essling	Scale and mealybug: what can I do to control these sap-sucking insects?		
E.N. Wilkes	No- and low-alcohol wines	FIVS meeting, Santa Rosa, USA	
M.L. Longbottom	Sustainable Winegrowing Australia update	Freshcare meeting of certification bodies (virtual)	14 Nov 2022
	Sustainable Winegrowing Australia: Adelaide Hills 2022 results	Adelaide Hills Wine Region member group, Hahndorf, SA	
M. Parker	Linking wine composition with sensory perception of smoke taint	Oneoviti Mini Symposium (virtual)	15 Nov 2022
A.R. Rinaldo	<i>Brettanomyces</i> in the winery: management and detection	Fermentis Academy, Tanunda, SA	
M. Essling	Agrochemical options for control of fungal disease	Adelaide Hills Wine Region 'Vineyard management in a wet season' workshop, Balhannah, SA	
M.G. Holdstock	Evaluation of wines made from different undervine cover crop treatments: Vintage 2020	Langhorne Creek Wine Association member workshop, Langhorne Creek, SA	16 Nov 2022
M.L. Longbottom	Sustainable Winegrowing Australia: Langhorne Creek 2022 results		

Staff	Title of presentation	Presented to and where	Date
M.L. Longbottom	Sustainability: global insights and introduction	Sustainable Winegrowing in Rutherglen workshop, Rutherglen, VIC	22 Nov 2022
	Sustainable Winegrowing Australia: Rutherglen project overview		
	Sustainable Winegrowing Australia: Rutherglen 2022 results		
	Sustainability case study: The Madgett's Block		
	Sustainability case study: Chandon		
	Sustainability action planning		
S. Nordestgaard, W.-H. Hsieh	Autonomous tractors/robots: update from last year	Vineyard autonomy demo morning, Barossa, SA	23 Nov 2022
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training (virtual)	28 Nov 2022
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
C.M. Brodie	Internal audits		
	Sustainability action planning and benchmarking reports		
L.M. Pitcher	Biosecurity		
	Pest and disease management in vineyards and winery chemicals		
C.M. Brodie	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
	Sustainable Winegrowing Australia certification workshop: follow-up	AWISSP certification training follow-up session (virtual)	29 Nov 2022
G.D. Cowey, B.H.C. Cordingley	Wine taints and faults threshold exercise	Australian Vintage Limited, Sunraysia, NSW	30 Nov 2022
C.M. Brodie	Biodiversity		
L.M. Pitcher	Waste		
	Air quality		
C.M. Brodie	Energy and fuel		
L.M. Pitcher	Scope and commitment to sustainability		
	Documentation		
C.M. Brodie	Training and development		
	Suppliers		
	Customer and regulatory requirements		
L.M. Pitcher	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
M.L. Longbottom	Introduction to Sustainable Winegrowing Australia certification	AWISSP certification training, Geelong, VIC	1 Dec 2022
L.M. Pitcher	Property maps		
M.L. Longbottom	Internal audits		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
L.M. Pitcher	Water and wastewater		



Staff	Title of presentation	Presented to and where	Date
M.L. Longbottom	Energy and fuel	AWISSP certification training, Geelong, VIC	1 Dec 2022
L.M. Pitcher	Scope and commitment to sustainability		
M.G. Holdstock	Welcome and introduction	Techniques for improving fermentation performance workshop, Margaret River, WA	
S.A. Schmidt	The beneficial style and performance effects of oxygen addition during fermentation		
	Fermentation nutrient management		
J.L. Hixson	Increasing wine flavour by foliar application of nitrogen and sulfur in the vineyard		
M.L. Longbottom	Sustainability: global insights and introduction	Introduction to Sustainable Winegrowing Australia, Heathcote, VIC	2 Dec 2022
	Sustainable Winegrowing Australia: Heathcote		
L.M. Pitcher	Sustainability case study: Lake Moodemere Estate		
	Sustainability case study: The Madgett's Block		
	Sustainability case study: Chandon		
	Sustainable Winegrowing Australia: getting started		
W. Jiang	Smoke and wine: learning from the past and preparing for the future	Waite Research Institute Showcase, Adelaide, SA	5 Dec 2022
C.A. Simos	Introduction to the Advanced Wine Assessment Course	Advanced Wine Assessment Course (AWAC 55), Adelaide, SA	
G.D Cowey	Flavour, taints, faults and thresholds		
R. Gawel	Palate performance and statistical evaluation		
M.L. Longbottom	Introduction to Sustainable Winegrowing Australia certification	AWISSP certification training, Coonawarra, SA	6 Dec 2022
M.Z Bekker, M. Parker	The current state of RD&A projects relevant to ESG	KPMG and Wine Australia ESG workshop, Adelaide, SA	
C.A. Simos	Welcome and introduction to services provided by the AWRI	AWRI roadshow seminar, Campbell Town, TAS	
M. Essling	Understanding powdery mildew and strategies to help control the disease		
A.J. Borneman	Bringing science to wild wine		
J.L. Hixson	The flavour of bottle-aged Riesling: predicting and controlling future chemistry		
M. Essling	Scale and mealybug: what can I do to control these sap-sucking insects?		
C.M. Brodie	Property maps	AWISSP certification training, Coonawarra, SA	
	Internal audits		
M.L. Longbottom	Sustainability action planning and benchmarking reports		
	Biosecurity		
C.M. Brodie	Pest and disease management in vineyards and winery chemicals		
M.L. Longbottom	Land, soil and nutrient management		
C.M. Brodie	Water and wastewater		
M.L. Longbottom	Biodiversity		
C.M. Brodie	Waste		
M.L. Longbottom	Air quality		
	Energy and fuel		
C.M. Brodie	Scope and commitment to sustainability		
	Documentation		

Staff	Title of presentation	Presented to and where	Date
M.L. Longbottom	Training and development	AWISSP certification training, Coonawarra, SA	6 Dec 2022
C.M. Brodie	Suppliers		
	Customer and regulatory requirements		
M.L. Longbottom	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
M. Essling	Welcome and introduction to spray application	Spray application workshop, Kayena, TAS	7 Dec 2022
S. Nordestgaard	Next generation wineries	AWRI webinar	8 Dec 2022
M. Essling	Welcome and introduction to spray application	Spray application workshop, Campania, TAS	
M.L. Longbottom	Australia: making a world of difference in wine	Australian Agriculture Sustainability Framework Community of Practice, Canberra, ACT	13 Dec 2022
A.D. Coulter	Origins of taints and contaminations	Institute of Masters of Wine webinar	14 Dec 2022
S. Nordestgaard	Which new products and equipment have had the biggest impact in vineyards and wineries?	AWRI webinar	15 Dec 2022
L.M. Pitcher	Sustainable Winegrowing Australia certification workshop: follow-up	AWISSP certification training follow-up session (virtual)	20 Dec 2022
C.A. Simos	Wine taints and faults	Institute of Masters of Wine, Rust, Austria	13 Jan 2023
M.L. Longbottom	Sustainability: global insights	Introduction to Sustainable Winegrowing Australia workshop, Mildura, VIC	17 Jan 2023
	Sustainable Winegrowing Australia: a regional perspective		
	Sustainable Winegrowing Australia: regional data		
	Sustainable Winegrowing Australia case studies		
	Getting started with Sustainable Winegrowing Australia		
	Sustainability: global insights and introduction	AWISSP certification training, Adelaide, SA	20 Jan 2023
	Introduction to Sustainable Winegrowing Australia certification		
	Internal audits		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
	Land, soil and nutrient management		
	Biodiversity		
	Energy and fuel		
	Scope and commitment to sustainability		
	Training and development		
	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
M.G. Holdstock	Packaging wine: preventing problems post-bottling	Institute of Masters of Wine seminar, Adelaide, SA	25 Jan 2023
G.D. Cowey	Wine flavours, faults and taints		31 Jan 2023

Staff	Title of presentation	Presented to and where	Date
M.P. Krstic	Overview of the AWRI	Department of Industry, Innovation and Science, Adelaide, SA	6 Feb 2023
M.L. Longbottom	Sustainable Winegrowing Australia: why and how?	FOMENT, Adelaide, SA	
R. Dixon	Introduction	Introduction to Sustainable Winegrowing Australia and carbon calculating workshop, Milawa, VIC	7 Feb 2023
K.C. Hirlam	Carbon neutral: why and how?		
L.M. Pitcher	Sustainable Winegrowing Australia: why and how?		
	Sustainable Winegrowing Australia: data across Greater Victoria		
C.M. Brodie	Sustainability in action: case studies		
K.C. Hirlam	Carbon footprinting in vineyards and wineries		8 Feb 2023
R. Dixon	Introduction		
K.C. Hirlam	Carbon neutral: why and how?		
L.M. Pitcher	Sustainable Winegrowing Australia: why and how?		
	Sustainable Winegrowing Australia: data across Greater Victoria		
C.M. Brodie	Sustainability in action: case studies		
K.C. Hirlam	Carbon footprinting in vineyards and wineries		
M.L. Longbottom	Sustainable Winegrowing Australia: why and how?	Pinot Noir Celebration Australia 2023, Cape Shanck, VIC	11 Feb 2023
E.O. Bilogrevic	Smoke taint and consumers: how do consumers respond to wines made from grapes exposed to bushfire smoke?	17 <sup>th</sup> New Zealand and Australia (NZOZ) Sensory and Consumer Science Symposium, Wanaka, New Zealand	13 Feb 2023
L.M. Pitcher	Welcome and recap on December workshop	AWISSP certification training, Geelong, VIC	14 Feb 2023
C.M. Brodie	Land, soil and nutrient management		
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals		
C.M. Brodie	Biodiversity		
	Waste		
	Air quality		
L.M. Pitcher	Scope and commitment to sustainability		
	Documentation		
C.M. Brodie	Training and development		
	Suppliers		
L.M. Pitcher	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
D. Likos	Using time-intensity sensory evaluation to compare the effects of fructose and L-proline in Shiraz and Cabernet Sauvignon wines	17 <sup>th</sup> New Zealand and Australia (NZOZ) Sensory and Consumer Science Symposium, Wanaka, New Zealand	15 Feb 2023
L.M. Pitcher	Introduction	Introduction to Sustainable Winegrowing Australia and carbon calculating workshop, Ararat, VIC	
	Sustainable Winegrowing Australia: why and how?		



Staff	Title of presentation	Presented to and where	Date
K.C. Hirlam	Carbon neutral: why and how?	Introduction to Sustainable Winegrowing Australia and carbon calculating workshop, Ararat, VIC	15 Feb 2023
L.M. Pitcher	Sustainable Winegrowing Australia: data across Greater Victoria		
C.M. Brodie	Sustainability in action: case studies		
K.C. Hirlam	Carbon footprinting in vineyards and wineries		
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training, Heathcote, VIC	16 Feb 2023
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
C.M. Brodie	Internal audits		
L.M. Pitcher	Sustainability action planning and benchmarking reports		
C.M. Brodie	Biosecurity		
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals		
C.M. Brodie	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
C.M. Brodie	Biodiversity		
	Waste		
	Air quality		
L.M. Pitcher	Energy and fuel		
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	Suppliers		
L.M. Pitcher	Customer and regulatory requirements		
C.M. Brodie	Incident management, corrective and preventative actions, management review		
L.M. Pitcher	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
	Introduction		
	Sustainable Winegrowing Australia: why and how?	Introduction to Sustainable Winegrowing Australia and carbon calculating workshop, Kyneton, VIC	17 Feb 2023
K.C. Hirlam	Carbon neutral: why and how?		
L.M. Pitcher	Sustainable Winegrowing Australia: data across Greater Victoria		
C.M. Brodie	Sustainability in action: case studies		
K.C. Hirlam	Carbon footprinting in vineyards and wineries		
M.L. Longbottom	Sustainable Winegrowing Australia update	Freshcare auditor calibration session (virtual)	20 Feb 2023
B.H.C. Cordingley	Is molecular SO <sub>2</sub> the new free SO <sub>2</sub> ?	Institute of Masters of Wine webinar	22 Feb 2023
M.L. Longbottom	Sustainable Winegrowing Australia update	Freshcare auditor calibration session (virtual)	27 Feb 2023
G.D. Cowey	Fermentation 101	Institute of Masters of Wine webinar	28 Feb 2023
M. Essling	The impact of climate change on viticulture		9 Mar 2023
Y. Sui	A combined ultrafiltration/heat/protease treatment for protein stabilisation of white wine	Enoforum Web Scientists 2023 (virtual)	13 Mar 2023

Staff	Title of presentation	Presented to and where	Date
C.A. Varela	Characterising yeast isolates associated with fermented beverages produced by Australia's Indigenous peoples	Institute of Brewing and Distilling Conference, Adelaide, SA	22 Mar 2023
M.P. Krstic	Overview and current research at the AWRI	Plant & Food Research, Blenheim, New Zealand	17 Apr 2023
		Bragato Research Institute, Blenheim, New Zealand	18 Apr 2023
C.A. Simos	Fine-tuning your red wine styles	Understanding the impact of grapevine viruses and enhancing fruit characters in winemaking workshop, Stanthorpe, QLD	20 Apr 2023
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training, Sunraysia, VIC	2 May 2023
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
	Land, soil and nutrient management		
	Water and wastewater		
	Waste		
	Air quality		
	Scope and commitment to sustainability		
	Documentation		
	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
B.H.C. Cordingley	Wine flavours, taints, faults and mouthfeel tasting	Wine flavours, taints and faults workshop (Rockford Wines), Adelaide, SA	4 May 2023
			5 May 2023
C.A. Simos	Introduction to the Advanced Wine Assessment Course	Advanced Wine Assessment Course (AWAC 56), Adelaide, SA	8 May 2023
G.D. Cowey	Introduction to wine show judging and recognition and description of wine flavours, taints and faults		
M.G. Holdstock	Palate performance and statistical evaluation		11 May 2023
R. Dixon	Climate change adaptation vs mitigation	Climate change adaptation in the vineyard workshop, Margaret River, WA	12 May 2023
C.M. Penfold	Non-chemical weed control		
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training, Riverland, SA	16 May 2023
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
	Land, soil and nutrient management		
	Water and wastewater		
	Waste		
	Air quality		

Staff	Title of presentation	Presented to and where	Date
L.M. Pitcher	Scope and commitment to sustainability	AWISSP certification training, Riverland, SA	16 May 2023
	Documentation		
	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
	Sustainability: global insights and introduction		
	Introduction to Sustainable Winegrowing Australia certification		17 May 2023
	Property maps		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
	Land, soil and nutrient management		
	Water and wastewater		
	Waste		
	Air quality		
	Scope and commitment to sustainability		
	Documentation		
	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
Y. Sui	A combined ultrafiltration/heat/protease treatment for protein stabilisation of white wine	Enoforum Italy 2023 (virtual)	
R. Dixon	Welcome and introduction to vine health	Vine health workshop, Swan Hill, VIC	18 May 2023
C.M. Penfold	Cover crop project update		
R. Dixon	Welcome and introduction to vine health	Vine health workshop, Mildura, VIC	19 May 2023
C.M. Penfold	Cover crop project update		
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training (virtual)	22 May 2023
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
	Internal audits		
	Sustainability action planning and benchmarking reports		
	Scope and commitment to sustainability		
	Documentation		
	Training and development		
	Suppliers		
	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		



Staff	Title of presentation	Presented to and where	Date
C.M. Brodie	Biosecurity	AWISSP certification training (virtual)	24 May 2023
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals		
C.M. Brodie	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
C.M. Brodie	Biodiversity		
	Waste		
	Air quality		
L.M. Pitcher	Energy and fuel		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
R. Dixon	Welcome and introduction to carbon neutrality	Carbon neutrality in the vineyard and winery workshop, Goulburn Valley, VIC	24 May 2023
C.M. Penfold	Undervine weed management: herbicides, cover cropping and sheep grazing		
S. Nordestgaard	Vineyard machinery		
C.M. Penfold	Cover crop establishment		
R. Dixon	Vineyard walk exploring site-specific emissions reduction strategies		
K.C. Hirlam	Practical emissions reduction strategies in the winery		
S. Nordestgaard	Improving winery energy and refrigeration efficiency		
	Emerging technologies for reducing CO <sub>2</sub> emissions		
K.C. Hirlam	The influence of packaging on emissions profiles		
R. Dixon	Winery walkthrough exploring site-specific emissions reduction strategies		
	Welcome and introduction to carbon neutrality	Carbon neutrality in the vineyard and winery workshop, Rutherglen, VIC	25 May 2023
C.M. Penfold	Undervine weed management: herbicides, cover cropping and sheep grazing		
S. Nordestgaard	Vineyard machinery		
C.M. Penfold	Cover crop establishment		
R. Dixon	Vineyard walk exploring site-specific emissions reduction strategies		
K.C. Hirlam	Practical emissions reduction strategies in the winery		
S. Nordestgaard	Improving winery energy and refrigeration efficiency		
	Emerging technologies for reducing CO <sub>2</sub> emissions		
K.C. Hirlam	The influence of packaging on emissions profiles		
R. Dixon	Winery walkthrough exploring site-specific emissions reduction strategies		
	Welcome and introduction to carbon neutrality	Carbon neutrality in the vineyard and winery workshop, Mildura, VIC	30 May 2023
C.M. Penfold	Undervine weed management: herbicides, cover cropping and sheep grazing		
S. Nordestgaard	Vineyard machinery		
C.M. Penfold	Cover crop establishment		
R. Dixon	Vineyard walk exploring site-specific emissions reduction strategies		
K.C. Hirlam	Practical emissions reduction strategies in the winery		
S. Nordestgaard	Improving winery energy and refrigeration efficiency		
	Emerging technologies for reducing CO <sub>2</sub> emissions		

Staff	Title of presentation	Presented to and where	Date
K.C. Hirlam	The influence of packaging on emissions profiles	Carbon neutrality in the vineyard and winery workshop, Mildura, VIC	30 May 2023
R. Dixon	Winery walkthrough exploring site-specific emissions reduction strategies		
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training, Mornington Peninsula, VIC	
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
	Land, soil and nutrient management		
	Water and wastewater		
	Waste		
	Air quality		
	Scope and commitment to sustainability		
	Documentation		
	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
E.N. Wilkes	Wine is low risk	India-Australia Wine Regulatory Forum, New Delhi, India	31 May 2023
	Laboratory proficiency, test methods and processes		
R. Dixon	Welcome and introduction to carbon neutrality	Carbon neutrality in the vineyard and winery workshop, Geelong, VIC	1 Jun 2023
C.M. Penfold	Undervine weed management: herbicides, cover cropping and sheep grazing		
S. Nordestgaard	Vineyard machinery		
C.M. Penfold	Cover crop establishment		
R. Dixon	Vineyard walk exploring site-specific emissions reduction strategies		
K.C. Hirlam	Practical emissions reduction strategies in the winery		
S. Nordestgaard	Improving winery energy and refrigeration efficiency		
	Emerging technologies for reducing CO <sub>2</sub> emissions		
K.C. Hirlam	The influence of packaging on emissions profiles		
R. Dixon	Winery walkthrough exploring site-specific emissions reduction strategies		
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training, Pyrenees, VIC	
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
	Land, soil and nutrient management		
	Water and wastewater		
	Waste		
	Air quality		

Staff	Title of presentation	Presented to and where	Date
L.M. Pitcher	Scope and commitment to sustainability	AWISSP certification training, Pyrenees, VIC	1 Jun 2023
	Documentation		
	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
R. Dixon	Welcome and introduction to carbon neutrality	Carbon neutrality in the vineyard and winery workshop, Yarra Valley, VIC	2 Jun 2023
C.M. Penfold	Undervine weed management: herbicides, cover cropping and sheep grazing		
S. Nordestgaard	Vineyard machinery		
C.M. Penfold	Cover crop establishment		
R. Dixon	Vineyard walk exploring site-specific emissions reduction strategies		
K.C. Hirlam	Practical emissions reduction strategies in the winery		
S. Nordestgaard	Improving winery energy and refrigeration efficiency		
	Emerging technologies for reducing CO <sub>2</sub> emissions		
K.C. Hirlam	The influence of packaging on emissions profiles		
R. Dixon	Winery walkthrough exploring site-specific emissions reduction strategies		
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training, Riverland, SA	7 Jun 2023
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
C.M. Brodie	Internal audits		
L.M. Pitcher	Sustainability action planning and benchmarking reports		
C.M. Brodie	Biosecurity		
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals		
C.M. Brodie	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
C.M. Brodie	Biodiversity		
	Waste		
	Air quality		
L.M. Pitcher	Energy and fuel		
	Scope and commitment to sustainability		
	Documentation		
C.M. Brodie	Training and development		
	Suppliers		
L.M. Pitcher	Customer and regulatory requirements		
C.M. Brodie	Incident management, corrective and preventative actions, management review		
L.M. Pitcher	Winery product identification, traceability, withdrawal and recall requirements		

Staff	Title of presentation	Presented to and where	Date
L.M. Pitcher	Sustainable Winegrowing Australia trust mark use	AWISSP certification training, Riverland, SA	7 Jun 2023
	Audit preparation and subsequent actions		
	Sustainability: global insights and introduction		
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
C.M. Brodie	Internal audits		
L.M. Pitcher	Sustainability action planning and benchmarking reports		
C.M. Brodie	Biosecurity		
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals		
C.M. Brodie	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
C.M. Brodie	Biodiversity		8 Jun 2023
	Waste		
	Air quality		
L.M. Pitcher	Energy and fuel		
	Scope and commitment to sustainability		
	Documentation		
C.M. Brodie	Training and development		
	Suppliers		
L.M. Pitcher	Customer and regulatory requirements		
C.M. Brodie	Incident management, corrective and preventative actions, management review		
L.M. Pitcher	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
	Sustainability: global insights and introduction	AWISSP certification training, Macedon Ranges, VIC	13 Jun 2023
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
C.M. Brodie	Internal audits		
L.M. Pitcher	Sustainability action planning and benchmarking reports		
C.M. Brodie	Biosecurity		
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals		
C.M. Brodie	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
C.M. Brodie	Biodiversity		
	Waste		
	Air quality		
L.M. Pitcher	Energy and fuel		
	Scope and commitment to sustainability		
	Documentation		
C.M. Brodie	Training and development		
	Suppliers		



Staff	Title of presentation	Presented to and where	Date
L.M. Pitcher	Customer and regulatory requirements	AWISSP certification training, Macedon Ranges, VIC	13 Jun 2023
C.M. Brodie	Incident management, corrective and preventative actions, management review		
L.M. Pitcher	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
P.J. Costello	Malolactic fermentation performance, diacetyl formation and sensory impacts of <i>Oenococcus oeni</i> following co-inoculation in Chardonnay	Crush 2023 Grape and Wine Science Symposium, Adelaide, SA	14 Jun 2023
J. Rossi	Improving wine yeast without the label: CRISPR-Cas9 production of non-GMO yeast with desirable winemaking characteristics		
Y. Sui	A combined ultrafiltration/heat/protease treatment for protein stabilisation of white wine		
W.-H. Hsieh	LoRaWAN soil sensors for vineyard monitoring		
C.A. Ward	The 1000 grapevine genomes project: cataloguing Australia's grapevine germplasm		
S. Nordestgaard	Low CO <sub>2</sub> emission tractors and robots	ASVO CO23 Climate Mitigation Conference, Adelaide, SA	15 Jun 2023
S.A. Schmidt	Opportunities for CellAg in adjacent fermentation industries	Fireside chat, CellAg Summit, Sydney, NSW	
L.M. Pitcher	Sustainability: global insights and introduction	AWISSP certification training, King Valley, VIC	
	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
C.M. Brodie	Internal audits		
L.M. Pitcher	Sustainability action planning and benchmarking reports		
C.M. Brodie	Biosecurity		
L.M. Pitcher	Pest and disease management in vineyards and winery chemicals		
C.M. Brodie	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
C.M. Brodie	Biodiversity		
	Waste		
	Air quality		
L.M. Pitcher	Energy and fuel		
	Scope and commitment to sustainability		
	Documentation		
C.M. Brodie	Training and development		
	Suppliers		
L.M. Pitcher	Customer and regulatory requirements		
C.M. Brodie	Incident management, corrective and preventative actions, management review		
L.M. Pitcher	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		

Staff	Title of presentation	Presented to and where	Date
C.A. Simos	Introduction to the Advanced Wine Assessment Course	Advanced Wine Assessment Course (AWAC 57), Adelaide, SA	15 Jun 2023
B.H.C. Cordingley	Introduction to wine show judging and recognition and description of wine flavours, taints and faults		
M.G. Holdstock	Palate performance and statistical evaluation		18 Jun 2023
	AWRI wine assessment introduction	Barossa Wine Assessment Training, Vine Vale, SA	20 Jun 2023
	Palate performance and statistical evaluation		21 Jun 2023
M.L. Longbottom	Sustainability: global insights and introduction	AWISSP certification training, Adelaide, SA	23 Jun 2023
L.M. Pitcher	Introduction to Sustainable Winegrowing Australia certification		
	Property maps		
	Internal audits		
	Sustainability action planning and benchmarking reports		
	Biosecurity		
	Pest and disease management in vineyards and winery chemicals		
M.L. Longbottom	Land, soil and nutrient management		
L.M. Pitcher	Water and wastewater		
M.L. Longbottom	Biodiversity		
L.M. Pitcher	Waste		
	Air quality		
M.L. Longbottom	Energy and fuel		
L.M. Pitcher	Scope and commitment to sustainability		
	Documentation		
M.L. Longbottom	Training and development		
L.M. Pitcher	Suppliers		
	Customer and regulatory requirements		
	Incident management, corrective and preventative actions, management review		
	Winery product identification, traceability, withdrawal and recall requirements		
	Sustainable Winegrowing Australia trust mark use		
	Audit preparation and subsequent actions		
N. Scrimgeour	Using chemical and sensory methods to help ensure the quality, safety and compliance of spirits	Australian Distillers Association, Adelaide, SA	26 Jun 2023

## APPENDIX 2

## Events organised by AWRI staff

Staff	Title of event	Held	Date
R. Dixon, J. Scudds, W.G. McSorley, F. Blefari	Climate change adaptation: Building resilience in the vineyard workshop	Ararat, VIC	12 Jul 2022
C.A. Simos, J. Scudds, W.G. McSorley, F. Blefari	Wine taints and faults workshop	Solotel Hotels Group, Sydney, NSW	
R. Dixon, J. Scudds, W.G. McSorley, F. Blefari	Climate change adaptation: Building resilience in the vineyard workshop	Ararat, VIC	13 Jul 2022
M.L. Longbottom, L.M. Pitcher, L. Etheridge, J. Scudds, W.G. McSorley, F. Blefari	Sustainable Winegrowing Australia workshop (with regional update)	Yarra Valley, VIC	14 Jul 2022
R. Dixon, J. Scudds, W.G. McSorley, F. Blefari	Climate change adaptation: Building resilience in the vineyard workshop	Mornington Peninsula, VIC	15 Jul 2022
M.L. Longbottom, J. Scudds, L.M. Pitcher	AWISSP certification training	Adelaide, SA	22 Jul 2022
C.A. Simos, J. Scudds, W.G. McSorley, F. Blefari	Pruning and vine health for vineyard longevity	Yarra Valley, VIC	26 Jul 2022
	Improving soil health and controlling insect pests for greater productivity	Mildura, VIC	
C.A. Simos, J. Scudds, W.G. McSorley, F. Blefari	Pruning and vine health for vineyard longevity	Mornington Peninsula, VIC	27 Jul 2022
	Improving soil health and controlling insect pests for greater productivity	Swan Hill, VIC	
		Pruning and vine health for vineyard longevity	Barossa Valley, SA
L.M. Pitcher, J. Scudds, F. Blefari, M.L. Longbottom	AWISSP certification training	Margaret River, WA	2 Aug 2022
C.A. Simos, J. Scudds, W.G. McSorley, F. Blefari	Pruning and vine health for vineyard longevity	Orange, NSW	
L.M. Pitcher, J. Scudds, F. Blefari, M.L. Longbottom	AWISSP certification training	Margaret River, WA	3 Aug 2022
C.A. Simos, J. Scudds, W.G. McSorley, F. Blefari	Pruning and vine health for vineyard longevity	McLaren Vale, SA	4 Aug 2022
		Adelaide Hills, SA	5 Aug 2022
C.A. Simos, J. Scudds, W.G. McSorley, F. Blefari, M. Essling		Margaret River, WA	9 Aug 2022
J. Scudds, F. Blefari, C.M. Brodie, M.L. Longbottom	AWISSP certification training	Adelaide, SA (virtual)	11 Aug 2022
M.G. Holdstock	Wine faults and taints	Gippsland, VIC (virtual)	
L.M. Pitcher, J. Scudds, C.M. Brodie, A. Hargrave	AWISSP certification training	Adelaide, SA	26 Aug 2022
C.M. Brodie, M.L. Longbottom, A. Hargrave, L.M. Pitcher		Limestone Coast, SA	30 Aug 2022
L.M. Pitcher, C.M. Brodie, A. Hargrave		Adelaide, SA (virtual)	5 Sep 2022
			7 Sep 2022
		Clare Valley, SA	8 Sep 2022
M.L. Longbottom, C.M. Brodie, A. Hargrave		Adelaide, SA	9 Sept 2022
L.M. Pitcher, A. Hargrave		Adelaide, SA (virtual)	13 Sep 2022
L.M. Pitcher, C.M. Brodie, A. Hargrave			15 Sep 2022
M.G. Holdstock, R. Dixon, R. Gawel, K.A. Bindon, M.Z. Bekker, A. Borneman, W.G. McSorley, F. Blefari, J. Scudds	AWRI roadshow seminar	Clare Valley, SA	28 Sep 2022
M.L. Longbottom, M.G. Holdstock, P.J. Costello, S. Nordestgaard, W.-H. Hsieh, A. Borneman, W.G. McSorley, A. Izzo, F. Blefari, J. Scudds		McLaren Vale, SA	29 Sep 2022
C.M. Brodie, L.M. Pitcher	AWISSP certification training follow-up session	Adelaide, SA (virtual)	11 Oct 2022
M. Essling, W.G. McSorley, J. Scudds, F. Blefari	Spray application workshop	Hunter Valley, NSW	17 Oct 2022

Staff	Title of event	Held	Date
R. Dixon, J. Scudds, C.A. Simos, M. Essling, A.L. Robinson, M.L. Longbottom, A.R. Rinaldo, A.J. Borneman, J.L. Hixson, S. Nordestgaard, W.-H. Hsieh, C. Schwarz, L.M. Pitcher	Advanced Viticulture Course (AVC 3)	Adelaide, SA	17-20 Oct 2022
L.M. Pitcher	AWISSP certification training follow-up session	Adelaide, SA (virtual)	18 Oct 2022
M.L. Longbottom, L.M. Pitcher, A. Hargrave	AWISSP certification training	Adelaide, SA	21 Oct 2022
R. Dixon, J. Scudds, C.A. Simos, M. Essling A.L. Robinson, M.L. Longbottom, A.R. Rinaldo, A.J. Borneman, J.L. Hixson, S. Nordestgaard, W.-H. Hsieh, C. Schwarz	Advanced Viticulture Course (AVC 4)		24-27 Oct 2022
L.M. Pitcher	AWISSP certification training follow-up session	Adelaide, SA (virtual)	25 Oct 2022
M.L. Longbottom	Introduction to Sustainable Winegrowing Australia	Geelong, VIC	27 Oct 2022
L.M. Pitcher	AWISSP certification training follow-up session	Adelaide, SA (virtual)	1 Nov 2022
C.M. Brodie, L.M. Pitcher	AWISSP certification training		2 Nov 2022
M.G. Holdstock, A. Izzo, F. Blefari, J. Scudds, M. Essling, W.G. McSorley, M.G. Holdstock, M.R. Solomon, C.M. Penfold	AWRI roadshow seminar	Orange, NSW	8 Nov 2022
C.M. Brodie, M.L. Longbottom	Introduction to Sustainable Winegrowing Australia	Wrattonbully, SA	
M.G. Holdstock, A. Izzo, F. Blefari, J. Scudds, M. Essling, W.G. McSorley, M.G. Holdstock, M.R. Solomon, C.M. Penfold	AWRI roadshow seminar	Southern Highlands, NSW	9 Nov 2022
M.G. Holdstock, A. Izzo, F. Blefari, J. Scudds, M. Essling, W.G. McSorley, M.G. Holdstock, M.R. Solomon, C.M. Penfold		Canberra, ACT	10 Nov 2022
M.L. Longbottom	Sustainable winegrowing in Rutherglen workshop	Rutherglen, VIC	22 Nov 2022
S. Nordestgaard, W.-H. Hsieh	Vineyard autonomy demo morning	Barossa Valley, SA	23 Nov 2022
L.M. Pitcher	AWISSP certification training follow-up session	Adelaide, SA (virtual)	28 Nov 2022
C.M. Brodie, A. Hargrave, L.M. Pitcher	AWISSP certification training		30 Nov 2022
G.D. Cowey, B.H.C. Cordingley, J. Scudds	Australian Vintage Limited: wine taints and faults threshold exercise	Sunraysia, NSW	
M.L. Longbottom, L.M. Pitcher, A. Hargrave	AWISSP certification training	Geelong, VIC	1 Dec 2022
M.G. Holdstock, J. Scudds, J.L. Hixson, S.A. Schmidt, F. Blefari, W.G. McSorley	Techniques for improving fermentation performance workshop	Margaret River, WA	
M.L. Longbottom, L.M. Pitcher, A. Hargrave	Introduction to Sustainable Winegrowing Australia	Heathcote, VIC	2 Dec 2022
C.A. Simos, J. Scudds, R. Gawel, F. Blefari, W.G. McSorley, C. Moutakis, B.H.C. Cordingley, G.D. Cowey, M.G. Holdstock	Advanced Wine Assessment Course (AWAC 55)	Adelaide, SA	5 Dec 2022
C.M. Brodie, M.L. Longbottom, A. Hargrave	AWISSP certification training	Coonawarra, SA	6 Dec 2022
M.G. Holdstock, W.G. McSorley, C.A. Simos, F. Blefari, J. Scudds, M. Essling, C.A. Simos, A.J. Borneman, J.L. Hixson	AWRI roadshow seminar	Campbell Town, TAS	
M. Essling, W.G. McSorley, C.A. Simos, F. Blefari, J. Scudds	Spray application workshop	Kayena, TAS	7 Dec 2022
		Campania, TAS	8 Dec 2022
M.L. Longbottom, A. Hargrave	Introduction to Sustainable Winegrowing Australia workshop	Mildura, VIC	17 Jan 2023
	AWISSP certification training	Adelaide, SA	20 Jan 2023
G.D. Cowey	Wine flavours, faults and taints workshop		31 Jan 2023
M.L. Longbottom, A. Hargrave, K.C. Hirlam, L.M. Pitcher, C.M. Brodie, R. Dixon	Introduction to Sustainable Winegrowing Australia and carbon calculating workshop	Milawa, VIC	7 Feb 2023
		Morwell, VIC	8 Feb 2023



Staff	Title of event	Held	Date
M.L. Longbottom, A. Hargrave, L.M. Pitcher, C.M. Brodie	AWISSP certification training	Geelong, VIC	14 Feb 2023
M.L. Longbottom, A. Hargrave, K.C. Hirlam, L.M. Pitcher, C.M. Brodie	Introduction to Sustainable Winegrowing Australia and carbon calculating workshop	Ararat, VIC	15 Feb 2023
M.L. Longbottom, A. Hargrave, L.M. Pitcher, C.M. Brodie	AWISSP certification training	Heathcote, VIC	16 Feb 2023
M.L. Longbottom, A. Hargrave, K.C. Hirlam, L.M. Pitcher, C.M. Brodie	Introduction to Sustainable Winegrowing Australia and carbon calculating workshop	Kyneton, VIC	17 Feb 2023
C.A. Simos, W.G. McSorley, F. Blefari, J. Scudds	Understanding the impact of grapevine viruses and enhancing fruit characters in winemaking workshop	Stanthorpe, QLD	20 Apr 2023
M.L. Longbottom, A. Hargrave, L.M. Pitcher	AWISSP certification training	Mildura, VIC	2 May 2023
B.H.C. Cordingley, F. Blefari, M. Calabrese, W.G. McSorley, J. Scudds	Wine flavours, taints and faults workshop	Rockford Wines staff, Adelaide, SA	4 May 2023 5 May 2023
C.A. Simos, J. Scudds, B.H.C. Cordingley, F. Blefari, G.D. Cowey, M. Calabrese, M.G. Holdstock, W.G. McSorley	Advanced Wine Assessment Course (AWAC 56)	Adelaide, SA	8-11 May 2023
R. Dixon, W.G. McSorley, F. Blefari, J. Scudds, M. Calabrese, C.M. Penfold	Climate change adaptation in the vineyard workshop	Margaret River, WA	12 May 2023
M.L. Longbottom, A. Hargrave, L.M. Pitcher	AWISSP certification training	Loxton, SA	16 May 2023 17 May 2023
R. Dixon, W.G. McSorley, F. Blefari, J. Scudds, M. Calabrese, C.M. Penfold	Vine health workshop	Swan Hill, VIC	18 May 2023
R. Dixon, W.G. McSorley, F. Blefari, J. Scudds, M. Calabrese, C.M. Penfold		Mildura, VIC	19 May 2023
M.L. Longbottom, A. Hargrave, L.M. Pitcher	AWISSP certification training	Adelaide, SA (virtual)	22 May 2023
R. Dixon, M. Calabrese, F. Blefari, J. Scudds, S. Nordestgaard, W.G. McSorley, C.M. Penfold, K.C. Hirlam	Carbon neutrality in the vineyard and winery workshop	Goulburn Valley, VIC	24 May 2023
		Rutherglen, VIC	25 May 2023
		Mildura, VIC	30 May 2023
M.L. Longbottom, A. Hargrave, L.M. Pitcher	AWISSP certification training	Red Hill, VIC	30 May 2023
R. Dixon, M. Calabrese, F. Blefari, J. Scudds, K.C. Hirlam, S. Nordestgaard, W.G. McSorley, C.M. Penfold	Carbon neutrality in the vineyard and winery workshop	Geelong, VIC	1 Jun 2023
M.L. Longbottom, A. Hargrave, L.M. Pitcher	AWISSP certification training	Avoca, VIC	
R. Dixon, M. Calabrese, F. Blefari, J. Scudds, K.C. Hirlam, S. Nordestgaard, W.G. McSorley, C.M. Penfold	Carbon neutrality in the vineyard and winery workshop	Yarra Valley, VIC	2 Jun 2023
M.L. Longbottom, A. Hargrave, L.M. Pitcher	AWISSP certification training	Loxton, SA	7 Jun 2023
		Lancefield, VIC	8 Jun 2023 13 Jun 2023
C.A. Simos, J. Scudds, B.H.C. Cordingley, F. Blefari, G.D. Cowey, M. Calabrese, M.G. Holdstock, W.G. McSorley	Advanced Wine Assessment Course (AWAC 57)	Adelaide, SA	15-18 Jun 2023
M.L. Longbottom, A. Hargrave, L.M. Pitcher	AWISSP certification training	Ararat, VIC	15 Jun 2023
M.G. Holdstock, W.G. McSorley	Barossa Wine Assessment Training	Vine Vale, SA	20-21 Jun 2023
M.L. Longbottom, A. Hargrave, L.M. Pitcher	AWISSP certification training	Adelaide, SA	23 Jun 2023
C.A. Simos, J. Scudds, F. Blefari, G.D. Cowey, M. Calabrese, M.G. Holdstock, W.G. McSorley	Advanced Wine Technology Course (AWTC 1)		26-29 Jun 2023

## APPENDIX 3

### Posters

Staff	Title of poster	Presented at	Date
E.O. Bilogrevic, M. Parker, J. Culbert, W. Jiang, D. Likos, M.J. Herderich, I.L. Francis	The consumer response to smoke flavour in wine	EuroSense, Turku, Finland	13-16 Sep 2022
F.T. Watson, D. Teng, N.D.R Lloyd, S. Kassara, D. Espinase Nandorfy	Automated quantitation of taste-active metabolites in red wine	Practical applications of NMR in industry conference (PANIC), San Diego, USA	16-19 Oct 2022
N. Scrimgeour, K.C. Hirlam, N.D.R Lloyd, E.O. Bilogrevic, D. Likos, M. Wheal, Y. Sui, S. Madaras, P. Solomon, E.N. Wilkes	Chemical and sensory benchmarking of different whisky styles	Institute of Brewing and Distilling Conference, Adelaide, SA	21-23 Mar 2023
A.H. Forgan, K.M. Cuijvers, S.A. Schmidt	Extensive microbe collections for your fermentations		
A.R. Rinaldo, C.E. Bartel, M. Schoeman	Using flow cytometry to measure yeast vitality in brewing		
D. Likos, D. Espinase Nandorfy, E.O. Bilogrevic, I.L. Francis	Utilising rapid sensory methods for profiling spirits		
C.A. Varela, C.E. Bartel, A.R. Borneman	A needle in a haystack: finding high flavour distilling yeasts among thousands of isolates		

## APPENDIX 4

### Teaching responsibilities (lectures) of AWRI staff

Institution	Subject number	Subject name	No. of lectures	Staff member
University of Adelaide	3046WT/7046WT	Fermentation technology III	2	M.Z. Bekker
	7530EX	Grape and wine production	1	J.A. Gledhill
	3037WT	Distillation, fortification and sparkling wine III	10	
	7010WT	Stabilisation and clarification	3	A.D. Coulter
Flinders University	BTEC8008	Applications of nanotechnology in wine production and quality	1	A. Mierczynska-Vasilev
Charles Sturt University	WSC202	Wine production I	1	P.J. Costello

## APPENDIX 5

## Student supervision responsibilities of AWRI staff

Student	Supervisors	Source of funds
<b>PhD</b>		
Jana Hildebrandt	J.L. Hixson, I.L. Francis, M.J. Herderich, M.A. de Barros Lopes <sup>1</sup>	Wine Australia, Australian Government Research Training Program Scholarship
Yiming Huo	K.L. Wilkinson <sup>2</sup> , R. Muhlack <sup>2</sup> , M.J. Herderich	CPC-P, University of Adelaide
Stephanie Angela	K.L. Wilkinson <sup>2</sup> , K.A. Bindon, R. Muhlack <sup>2</sup> , A. Mierczynska-Vasilev	University of Adelaide
Yanina Giordana	A.R. Borneman, P. Grbin <sup>2</sup>	ARC ITTC-2, University of Adelaide
Natalia Caliani	A.R. Borneman, V. Jiranek <sup>2</sup> , K. Sumby <sup>2</sup>	ARC ITTC-2, University of Adelaide
Ysadora Mirabelli-Montan	K.L. Wilkinson <sup>2</sup> , M. Parker, D.W. Jeffery <sup>2</sup>	ARC Linkage grant, University of Adelaide
Yu Hou	M.Z. Bekker, D.W. Jeffery <sup>2</sup>	AWRI-University of Adelaide Collaborative Research Partnership Fund, University of Adelaide-Wine Australia scholarship
Andres Zhou Tsang	M. Gilliam <sup>2</sup> , A.R. Borneman, M. Walker <sup>3</sup>	ARC ITTC-2, University of Adelaide
WenWen Jiang	K.L. Wilkinson <sup>2</sup> , M. Parker, J. Mortimer <sup>2</sup>	AATSE Elevate scholarship
Damian Espinase Nandorfy	I.L. Francis, R. Keast <sup>4</sup> , R. Shellie <sup>4</sup> , J. Bekkers <sup>5</sup>	Wine Australia
Kamalpreet Kaur	F.E. Constable <sup>6</sup> , B Rodoni <sup>6</sup> , A.R. Rinaldo	Wine Australia, La Trobe University
Qi Wu	S.D. Tyerman <sup>2</sup> , N. Habili, F.E. Constable <sup>6</sup>	University of Adelaide, Wine Australia
Matija Leskovic	W.J du Toit <sup>7</sup> , M.Z. Bekker, J. Brand <sup>7</sup>	University of Stellenbosch
Sarah Schneidemmann	M.J. Herderich, M. Rychlik <sup>8</sup>	Technische Universität Munich
<b>Masters</b>		
Berlia Roux	W.J. du Toit <sup>7</sup> , M.Z. Bekker	University of Stellenbosch
Bryce Polley	K. Mengersen <sup>9</sup> , K. Helmstedt <sup>9</sup> , M.L. Longbottom, M. Mitchell <sup>10</sup>	Food Agility CRC, AWRI, QUT
Affiliations: <sup>1</sup> University of South Australia, <sup>2</sup> University of Adelaide, <sup>3</sup> CSIRO, <sup>4</sup> Deakin University, <sup>5</sup> The Australian National University, <sup>6</sup> La Trobe University, <sup>7</sup> Stellenbosch University, <sup>8</sup> Technische Universität Munich, <sup>9</sup> QUT, <sup>10</sup> Food Agility CRC		

## APPENDIX 6

# Media interviews

Date	Staff member	Discussed	Media
1 Jul 2022	J.L. Hixson	Flavour from glycoside extracts	Sonya Logan, <i>Australian &amp; New Zealand Grapegrower &amp; Winemaker</i>
15 Jul 2022	M.P. Krstic	Reflections on the 18 <sup>th</sup> AWITC	Harrison Davies, <i>Australian &amp; New Zealand Grapegrower &amp; Winemaker</i>
2 Aug 2022	E.N. Wilkes	Authenticating wine	Madi Chwasta, <i>ABC Radio Melbourne</i>
10 Aug 2022	A.R. Borneman	Synthetic yeast chromosome	Eliza Berlage, <i>ABC Riverland</i>
12 Oct 2022	M. Essling	Effects of sustained wet weather in vineyards	Elsie Lange, <i>Star Weekly</i>
31 Oct 2022	M. Parker and P.O. Williamson	Why does wine taste good?	Brian Cox and Robin Ince, <i>BBC The Infinite Monkey Cage</i> podcast
5 Nov 2022	W.P. Pearson	Research at the AWRI	Richo Doumani, <i>The Wine Show</i> podcast
9 Nov 2022		NOLO wines	Christine Middap, <i>The Weekend Australian</i>
14 Dec 2022	A.R. Borneman	Synthetic biology	Simone Madden-Gray, <i>Australian &amp; New Zealand Grapegrower &amp; Winemaker</i>
19 Dec 2022	W.P. Pearson	NOLO wines	Jacinta Bowler, <i>Cosmos Magazine</i>
25 Jan 2023	M.L. Longbottom	Sustainable Winegrowing Australia	Rebecca Price, <i>Drinks Trade</i>
28 Feb 2023		Sustainable Winegrowing Australia Impact report	Liv Casben, <i>Australian Associated Press</i>
7 Mar 2023		Sustainable Winegrowing Australia	Harrison Davies, <i>Australian &amp; New Zealand Grapegrower &amp; Winemaker</i>
28 Mar 2023			Veronica Labenia, <i>The Wolf Post</i> , Italy
4 Apr 2023	W.P. Pearson	Launch of NOLO trial-scale research facility	Christine Webster, <i>InDaily</i>
19 Apr 2023		Low-alcohol wine	Thomas Carr, <i>The Guardian</i>
	M.L. Longbottom	Sustainable Winegrowing Australia	Simone Madden-Grey, <i>Australian &amp; New Zealand Grapegrower &amp; Winemaker</i>
20 Apr 2023	W.P. Pearson	NOLO wine filterability	Sonya Logan, <i>Winetitles</i>
4 May 2023	M.Z. Bekker	Thiols in wine	Alex Russan, <i>SevenFifty Daily</i>
10 May 2023	S.J. Nordestgaard	Carbon capture in wineries	Harrison Davies, <i>Winetitles</i>
15 May 2023	W.P. Pearson	NOLO wine	Georgina McKay, <i>Bloomberg News</i>
16 May 2023	M.L. Longbottom	What is Sustainable Winegrowing Australia and why is it important?	Kerrie Lush, <i>Riverland Wine Industry Hub</i> podcast
26 Jun 2023	J.A. Gledhill	NOLO wine production	NOLO wine video, <i>Treasury Wine Estates</i>



## APPENDIX 7

## Papers published by AWRI staff recorded during 2022/23

- 2309** Grebneva, Y., Bilogrevic, E., Rauhut, D., Herderich, M., Hixson, J.L. 2022. Impacts of photosensitive bunch zone shading on the volatile composition and sensory attributes for *Vitis vinifera* L. cv. Riesling. *OENO One* 56(3): 313-326.
- 2310** Coulter, A. 2022. Ask the AWRI: Stinky sulfur compounds in wine. *Aust. N.Z. Grapegrower Winemaker* (704): 85-86.
- 2311** Gonzaga, L.S., Danner, L., Bindon, K., Gledhill, J., James, A., Collins, C., Bonada, M., Petrie, P., Bastian, S. 2022. Revealing the Barossa zone sub-divisions through sensory and chemical analysis of Shiraz wine. iVES Conference Series. *Proceedings of the 2<sup>nd</sup> ClimWine Symposium, July 3-8, 2022*. <https://ives-openscience.eu/13228/>
- 2312** Cordingley, B., Coulter, A., Cowey, G., Dixon, R., Essling, M., Holdstock, M., Longbottom, M., Penfold, C., Pitcher, L., Schwarz, C., Simos, C., Krstic, M. 2022. Vintage 2022 – observations from the AWRI helpdesk. *Wine Vitic. J.* 37(4): 36-38.
- 2313** Corsi, A.M., Dolan, R., Goodman, S., Pearson, W. 2022. Exploring the attitudes and expectations of Australian drinkers and non-drinkers towards low and no-alcohol wines. *Wine Vitic. J.* 37(4): 70-72.
- 2314** Dry, P., Smart, R. 2022. Varietal choice for a warmer future. *Wine Vitic. J.* 37(4): 54-61.
- 2315** Dry, P. 2022. Pecorino. *Wine Vitic. J.* 37(4): p. 67.
- 2316** Ismail, I., McKay, S., Van Den Heuvel, S., Borneman, A., Sosnowski, M. 2022. Evaluation of spore collection methods for detection and quantification of fungicide resistance in powdery mildew. *Wine Vitic. J.* 37(4): 46-52.
- 2317** Nordestgaard, S. 2022. History and recent developments in under-vine weeding equipment. *Aust. N.Z. Grapegrower Winemaker* (705): 50-61.
- 2318** Schwarz, C. 2022. Ask the AWRI: How's the weather? *Aust. N.Z. Grapegrower Winemaker* (705): 50-61.
- 2319** Dixon, R., Cowey, G. 2022. Vineyard nitrogen management in a urea-limited world. *Aust. N.Z. Grapegrower Winemaker* (706): 54-55.
- 2320** Ntuli, R.G., Saltman, Y., Ponangi, R., Jeffery, D.W., Bindon, K., Wilkinson, K.L. 2022. Impact of skin contact time, oak and tannin addition on the chemical composition, color stability and sensory profile of Merlot wines made from flash détente treatment. *Food Chem.* 405 (Part A): 134849.
- 2321** Mierczyński, P., Dawid, B., Mierczynska-Vasilev, A., Maniukiewicz, W., Witońska, I., Vasilev, K., Szykowska-Jóźwik, M.I. 2022. Novel bimetallic 1%M-Fe/Al<sub>2</sub>O<sub>3</sub>-Cr<sub>2</sub>O<sub>3</sub> (2:1) (M = Ru, Au, Pt, Pd) catalysts for Fischer-Tropsch synthesis. *Catal. Commun.* 172: 106559.
- 2322** Jiang, W., Bilogrevic, E., Parker, M., Francis, I.L., Leske, P., Hayasaka, Y., Barter, S., Herderich, M. 2022. The effect of pre-veraison smoke exposure of grapes on phenolic compounds and smoky flavour in wine. *Aust. J. Grape Wine Res.* 2022: 9820204.
- 2323** Henschke, P., Borneman, A. 2022. Clonal mapping of Pinot Noir: Loss of source blocks in Adelaide Hills bushfires leads to clonal identification for Pinot Noir. *Aust. N.Z. Grapegrower Winemaker* (707): 35-37.
- 2324** Cowey, G., Schmidt, S. 2022. Ask the AWRI: Winery nutrient management in a DAP-limited world. *Aust. N.Z. Grapegrower Winemaker* (707): 46-47.
- 2325** Krstic, M. 2022. Australian Wine Research Institute: Annual Report 2022. *Aust. N.Z. Grapegrower Winemaker* (707): 76-79.
- 2326** Cordingley, B. 2023. Ask the AWRI: Thinking about pinking. *Aust. N.Z. Grapegrower Winemaker* (708): 46-47.
- 2327** Coulter, A. 2023. Ask the AWRI: Wine taints from oak. *Aust. N.Z. Grapegrower Winemaker* (709): 56-57.
- 2328** Scrimgeour, N. 2023. Achieving success with canned wines. *Aust. N.Z. Grapegrower Winemaker* (709): 84-87.
- 2329** Godden, P., Wilkes, E. 2023. Trends in the composition of Australian wine 1990 to 2021. Part one: Introduction, titratable acidity and pH. *Wine Vitic. J.* 38(1): 20-24.
- 2330** Scrimgeour, N., Hirlam, K., Hsieh, D., Wilkes, E., Krstic, M. 2023. Canned wine: Looking for a silver lining. *Wine Vitic. J.* 38(1): 28-34.
- 2331** Dry, P. 2023. Schioppettino. *Wine Vitic. J.* 38(1): p. 68.
- 2332** Mierczynska-Vasilev, A.M., Kulcsar, A.C., Dabare, P.R.L., Vasilev, K.A., Bekker, M. 2023. Surface nanoengineering technology for the removal of sulfur compounds associated with negative attributes in wines. *npj Sci. Food* 7: 5.
- 2333** Bekker, M.Z., Cuijvers, K.M., Kulcsar, A.C., Sanders, R.D., Capone, D.L., Jeffery, D.W., Schmidt, S.A. 2023. Effects of yeast strain and juice nitrogen status on glutathione utilisation during fermentation of model media. *Aust. J. Grape Wine Res.* 2023: 8041096.
- 2334** Varela, C., Alperstein, L., Sundstrom, J., Solomon, M., Brady, M., Borneman, A., Jiranek, V. 2023. A special drop: Characterising yeast isolates associated with fermented beverages produced by Australia's Indigenous peoples. *Food Microbiol.* 112: 104216.
- 2335** Payne, E.M., Taraji, M., Murray, B.E., Holland-Moritz, D.A., Moore, J.C., Haddad, P.R., Kennedy, R.T. 2023. Evaluation of analyte transfer between microfluidic droplets by mass spectrometry. *Anal. Chem.* 95(10): 4662-4670.
- 2336** Longbottom, M. 2023. Ask the AWRI: Understanding Australian sustainability credentials. *Aust. N.Z. Grapegrower Winemaker* (710): 45-46.
- 2337** Mierczyński, P., Mierczyńska-Vasilev, A., Maniukiewicz, W., Vasilev, K., Szykowska-Jozwik, M. 2023. Novel Cu and Pd-Cu catalysts supported on multi-walled carbon nanotubes for steam reforming and decomposition of methanol. *Catalysts* 13: 533.
- 2338** Wu, Q., Habili, N., Kinoti, W.M., Tyerman, S.D., Rinaldo, A., Zheng, L., Constable, F.E. 2023. A metagenomic investigation of the viruses associated with Shiraz disease in Australia. *Viruses* 15: 774.

- 2339** Mierczyński, P., Mierczyńska-Vasilev, A., Vasilev, K., Szykowska-Jozwik, M.I. 2023. Fourier transform infrared spectroscopic studies of methane and liquefied natural gas reforming processes on Ni/CeO<sub>2</sub> catalyst. *React. Kinet. Mech. Cat.* 136: 603–620.
- 2340** Godden, P., Wilkes, E. 2023. Trends in the composition of Australian wine 1990–2021. Part two: Alcohol and glucose plus fructose. *Wine Vitic. J.* 38(2): 30–33.
- 2341** Hirlam, K., Longbottom, M., Wilkes, E., Krstic, M. 2023. Understanding the greenhouse gas emissions of Australian wine production. *Wine Vitic. J.* 38(2): 34–36.
- 2342** Dry, P. 2023. Grillo. *Wine Vitic. J.* 38(2): p. 59.
- 2343** Dixon, R. 2023. Ask the AWRI: Assessing grapes for disease. *Aust. N.Z. Grapegrower Winemaker* (711): 90–91.
- 2344** Parker, M., Jiang, W.M., Bilogrevic, E., Likos, D., Gledhill, J., Coulter, A.D., Cowey, G.D., Simos, C.A., Francis, I.L., Herderich, M.J. 2023. Modelling smoke flavour in wine from chemical composition of smoke-exposed grapes and wine. *Aust. J. Grape Wine Res.* 2023: 4964850.
- 2345** Reilly, T., Mierczynski, P., Suwanto, A., Krido Wahono, S., Maniukiewicz, W., Vasilev, K., Bindon, K., Mierczynska-Vasilev, A. 2023. Using zeolites to cold stabilize white wines. *Aust. J. Grape Wine Res.* 2023: 7259974.
- 2346** Onetto, C.A., Kutyna, D.R., Kolouchova, R., McCarthy, J., Borneman, A.R., Schmidt, S.A. 2023. SO<sub>2</sub> and copper tolerance exhibit an evolutionary trade-off in *Saccharomyces cerevisiae*. *PLOS Genet.* 19(3): e1010692.
- 2347** Dabare, P.R., Reilly, T., Mierczynski, P., Bindon, K., Vasilev, K., Mierczynska-Vasilev, A. 2023. A novel solution to tartrate instability in white wines. *Food Chem.* 422: 136159.
- 2348** He, C., Xing, F., Liang, J., Zhang, Z., Zhan, B., Habili, N., Wang, H., Li, S. 2023. The ABI5-dependent downregulation of mitochondrial ATP synthase OSCP subunit facilitates apple necrotic mosaic virus infection. *J. Exp. Bot.* 2023: erad143.
- 2349** Habili, N., Wu, Q., Rinaldo, A., Constable, F. 2023. A chronological study on grapevine leafroll-associated virus 2 in Australia. *Viruses* 15(5): 1105.
- 2350** Cowey, G. 2023. Ask the AWRI: Traditional cap management techniques. *Aust. N.Z. Grapegrower Winemaker* (712): 58–59.
- 2351** Szeto, C., Lloyd, N., Nicolotti, L., Herderich, M.J., Wilkinson, K.L. 2023. Beyond volatile phenols: An untargeted metabolomic approach to revealing additional markers of smoke taint in grapevines (*Vitis vinifera* L.) cv Merlot. *J. Agric. Food Chem.* <https://doi.org/10.1021/acs.jafc.2c09013>
- 2352** Onetto, C.A., Ward, C.M., Borneman, A.R. 2023. The genome assembly of *Vitis vinifera* cv. Shiraz. *Aust. J. Grape Wine Res.* 2023: 6686706.
- 2353** Kaur, K., Rinaldo, A., Lovelock, D., Rodoni, B., Constable, F. 2023. The genetic variability of grapevine Pinot gris virus (GPGV) in Australia. *Virol. J.* 20: 211.
- 2354** Siebert, T. 2023. Chemical basis of ‘stone fruit’ aromas in white wine. *Chem. Aust.* (June–August): 40.
- 2355** Marangon, M., Seeley, P., Barocci, E., Milanowski, T., Mayr Marangon, C., Ricci, A., Bellon, J., Parpinello, G.P. 2023. Effect of interspecific yeast hybrids for secondary in-bottle alcoholic fermentation of English sparkling wines. *Foods* 12: 1995.
- 2356** Wylie, S., Habili, N. 2023. State-of-the-art plant virus research in Australasia. *Viruses* 15(6): 1311.
- 2357** Borneman, A. 2023. Ask the AWRI: Varietal and clonal identification of grapevines. *Aust. N.Z. Grapegrower Winemaker* (713): 38–39.
- 2358** Godden, P., Wilkes, E. 2023. Trends in the composition of Australian wine 1990–2021. Part three: free, total and bound sulfur dioxide concentrations, and the ratio of free to total SO<sub>2</sub> concentrations. *Wine Vitic. J.* 38(3): 32–38.
- 2359** Francis, L., Willing, E., Likos, D., Bilogrevic, E., Espinase Nandorfy, D., Pearson, W., Herderich, M., Krstic, M. 2023. An artist in residence at the AWRI: exploring synaesthesia and visual harmony with red wine flavour. *Wine Vitic. J.* 38(3): 40–44.
- 2360** Bilogrevic, E., Jiang, W.W., Culbert, J., Francis, L., Herderich, M., Parker, M. 2023. Consumer response to wine made from smoke-affected grapes. *OENO One* 57(2): 417–430.
- 2361** Costello, P.J., Kolouchova, R., McCarthy, J.M., Espinase Nandorfy, D., Likos, D., Schmidt, S.A. 2023. Transient acetaldehyde production by SO<sub>2</sub>-producing *Saccharomyces cerevisiae* promotes the survival of *Oenococcus oeni* during co-fermentation. *OENO One* 57(2): 399–415.
- 2362** Coulter, A. 2023. Ask the AWRI: Understanding copper hazes in wine. *Aust. N.Z. Grapegrower Winemaker* (714): 78–79.
- 2363** Mierczynski, P., Mierczynska-Vasilev, A., Szykowska-Jozwik, M.I., Ostrikov, K., Vasilev, K. 2023. Plasma-assisted catalysis for CH<sub>4</sub> and CO<sub>2</sub> conversion. *Catal. Commun.* 180: 106709.
- 2364** Wu, Q., Habili, N., Tyerman, S.D., Rinaldo, A., Little, A., Constable, F.E. 2023. First detection of five previously unreported grapevine viruses in Australia. *Australas. Plant Dis. Notes* 18: 27.
- 2365** Shaw, C.L., Dolan, R., Corsi, A.M., Goodman, S., Pearson, W. 2023. Exploring the barriers and triggers towards the adoption of low- and no-alcohol (NOLO) wines. *Food Qual. Pref.* 110: 104932.
- 2366** Longbottom, M. 2023. Ask the AWRI: Measuring the environmental footprint of Australian grapes and wine. *Aust. N.Z. Grapegrower Winemaker* (715): 74–75.
- 2367** Espinase Nandorfy, D., Siebert, T., Bilogrevic, E., Likos, D., Watson, F., Barter, S., Pisaniello, L., Kulcsar, A., Shellie, R.A., Keast, R., Francis, L., Bekker, M. 2023. The role of potent thiols in “emptyreumatic” flint/struck-match/mineral odours in Chardonnay wine. *Aust. J. Grape Wine Res.* 2023: 8847476.
- 2368** Bindon, K., Qi, S., Kassara, S., Nicolotti, L., Jouin, A., Beer, M. 2023. Apple pomace compositional data highlighting the proportional contribution of polymeric procyanidins. *Molecules* 28(14): 5494.

