Memorandum

TO: David Hunter, Habitat Planning

FROM: Steve Hamilton, Hamilton Environmental Services

DATE: 23rd September 2021

SUBJECT: The issue of vineyard spray drift in relation to the proposed residential development, 420-508 Perricoota Road, Moama

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I respond as requested to this issue by David Hunter of Habitat Planning, on behalf of the landholder, Perricoota Views Pty Ltd, as a suitably qualified person.

Location

A 108 lot residential subdivision is proposed at 420-508 Perricoota Road, Moama on Lot 1 DP1283567 and Lot 1-3 DP854487, some 4.7 km north-west of the CBD of Moama (see Fig. 1).

Figure 1 Aerial image of the general location of the assessed properties, outlined in red (Google Earth 2021).

The proposed subdivision area is bordered immediately to the north and east by active vineyards – part of the St. Anne's Vineyards Estate (see Fig. 2).

St. Anne's Vineyards grow Sauvignon Blanc in a VPS trellising system that appears to have strong canopy management, and where inter-rows maintain ground layer vegetation. There is currently minimal distance between the proposed development and the vineyard; the future boundary is defined by access tracks surrounding the vineyard, which will ultimately result in a 10 m minimum separation between the future fence line of lots within the proposed subdivision and the growing vines.

Figure 2 **Adjacent vineyards relative to the proposed development area.**

Vineyard spraying cycle

A typical vineyard will utilise a variety of sprays across the annual operational cycle of a vineyard (from Department of Primary Industries 2017):

- Fungicides are used to control outbreaks of Downy Mildew, Powdery Mildew, Botrytis and Phomopsis. Most of the time, these chemicals are applied by sprays only when required in the event of an outbreak or the onset of environmental conditions that are conducive to an outbreak, and not necessarily routinely, although some vineyards do preventative sprays of fungicides;
- Pesticides are also used to control outbreaks of a variety of pests, such as Lightbrown Apple Moth, Mites, Mealy Bugs, Snails, Scale, Grapevine Moth, Scale and Wingless Grasshoppers. Again, most of the time, these chemicals are applied by sprays only when required in the event of an outbreak or the onset of environmental conditions that are conducive to an outbreak;
- Herbicides are used in many vineyards to manage weeds under vine rows or on the inter-rows to control growth. St. Anne’s Vineyards appear to manage their inter-rows using mowing rather than spraying.

Vineyards will try to minimise spraying for both environmental and costs reasons, and many fungal and pest issues are best managed by appropriate vine canopy management to open up the canopy and reduce conducive environmental conditions for outbreaks – the St. Anne’s Vineyard planting appears to have well-managed canopies that are open, which would reduce the number of disease and pest issues and reduce the number of spraying required on an annual basis.

Spray drift from vineyards

There are a number of variables that influence the extent off-target movement of sprays, resulting in ‘spray drift’, and these variable have been subjected to considerable research (e.g. Australian Pesticides and Veterinary Medicines Authority (e.g. Hewitt 2001; APVMA 2008; Hewitt et al. 2010; Hewitt and O’Donnell 2013):

- Droplet size from the spray head – the larger the droplet, the less potential for drift, however, larger droplets from a spray head reduce spray coverage;
- Air speed and volume - Most spray units utilise air to transport spray from the nozzle to the vine canopy. The speed, volume and angle of air are critical in the effectiveness of spray deposition. Best practice spray application involves ensuring air volume and speed are matched to canopy size to achieve most efficient spray deposition without overspray or drift;
- Type of applicator – Ground applied sprayers include the Airblast sprayers, that use a fan with a large volume of air, and produce lots of spray drift, Multi-head or cross-flow fan sprayers use position fans to direct the spray to the canopy, Air-shear sprayers use a high velocity air stream to direct the spray to the canopy, and Tunnel and Recycle sprayers straddle the vine row and use shrouds/hoods to capture excess spray. These latter sprayers are the best applicator to minimise spray drift with ambient wind, and it is understood that St. Anne’s Vineyards utilises such a spray applicator;
- Height of release. Spray release height is another of the major factors affecting spray drift risk: the higher the release height, the greater the potential for off-target drift. In practice, release height for ground praying is usually controlled within relatively narrow limits;
- Environmental conditions – Wind speed and atmospheric stability are the main meteorological variables impacting on spray drift. Temperature and relative humidity also play a role but are less important.
    - The relationship between spray drift and wind speed is generally linear, as wind speed increases so does the spray drift. Unfortunately it is not that simple, at low wind speeds, wind direction is more variable and no wind is often associated with temperature

    inversion conditions. Spraying should usually be done where wind speeds are between 3 and 15 km/h.;
    - The typically unstable nature of the atmosphere during the daytime is conducive to the generation of spray drift because the turbulence promotes ready mixing;
    - The potential for or presence of a surface temperature inversion condition is a very important factor in spray drift risk management. Under normal conditions (i.e. where air is unstable near the ground) airborne droplets tend to rise and disperse in the atmosphere. Where there is surface temperature inversion, (i.e. the atmosphere is very stable near the ground) the airborne droplets can be 'trapped'. When this occurs, droplets may float away from the target resulting in unexpected drift. At wind speeds below 3 km/h there may be a local surface temperature inversion. In these conditions, it is recommended that spraying not be conducted (unless there is continuous heavy cloud cover) and, consequently, a low risk of a surface temperature inversion;
    - Temperature and relative humidity impact on the speed with which the chemicals within a spray droplet evaporate. As air temperature rises and relative humidity drops, there is an increase in the evaporation rate of droplets. The spray drift implications occur both as a result of the chemicals volatilising (and the potential for secondary drift) and because of the potential impacts of changes in particles size associated with the volatilisation of chemicals. The temperature (or more notably, the Delta T) at the time of spraying becomes important, and the use of a non-volatile additive is also useful to reduce the evaporation of droplets;
- Travel speed – Spray drift has been shown to increase with the travel speed of the vehicle spraying;
- Sprayer calibration and operator experience. Sprayers must be calibrated regularly to ensure that the correct amount of agrichemical is applied. Operator expertise is important in calibration, operation and general equipment maintenance in order to minimise potential malfunctions, spills or accidents;
- Buffer zones. A buffer zone can minimise the effect of primary spray drift by allowing an agrichemical to disperse to insignificant concentrations before reaching a sensitive area. Factors influencing the required width of a buffer zone include application technique, chemical used and the presence of a shelterbelt. Research and subsequent modelling has indicated negligible chemical drift at a range 300 m downwind from the release point of a chemical spray application and a minimum width of 40 m where a vegetated buffer element can be satisfactorily implemented and maintained;
- The presence of natural and artificial barriers. Densely planted trees or shrubs within the vineyard or on property boundaries can form useful barriers to prevent spray drift. The higher the shelter the better, but established vegetation of approximately 1-2 m wide and 3 m high can capture up to 60-90 % of low-level spray drift. Plantings of various tree and shrub species (with differing growth habits), spaced 4-5 m apart, with long, thin and rough foliage from the base to the crown are recommended. Artificial netting with porosity of 25-60 % can also be effective; results indicate that it catches up to 50 % of spray drift. However, research has shown drift potential may increase at far-field distances away for the spraying when vegetated or other physical barriers are used due to the impact of the barrier on aerodynamic flow causing an increase in air flow above the height of the barrier at its spatial location, directing the spray drift to several hundred metres from the source of the pray.

There have been several well-distributed Australian wine industry documents that outline best management practice in relation to spray drift minimisation.

Likelihood of spray drift issues in regard to proposed subdivision

The recently established Dungala Estate residential subdivision also on Perricoota Road, Moama, has also been established on common boundaries with vineyards that are part of the St. Anne's Vineyard estate. A report prepared for the developers of Dungala Estate by Hamilton Environmental Services (HES)(HES 2018), recommended that for that estate along such common boundaries to minimise the effects of spray drift, for affected lots to have a 1.8 m height colorbond fence along the boundary with the vineyard, and it was further proposed to incorporate an appropriate vegetation buffer along the outside of the boundary as well. Clearly, this vegetated buffer would take up to 5 years to reach a height to be fully effective in interception of spray drift.

In the case of the Dungala Estate, 1.8 m height colorbond fences on lots adjacent to any part of the vineyard have been established (see Plate 1). It was not possible to determine whether these boundary lines have been vegetated as recommended.

Plate 1 **Colorbond fencing of 1.8 m height on lot boundaries of the Dungala Estate, Moama, adjacent to vineyards operated by St. Anne's Vineyard (images taken 26th February 2021).**

As recommended in the case of Dungala Estate, it is recommended for this development that affected development lots have a 1.8 m height colorbond fence along the boundary with the vineyard, and it is further recommended to incorporate an appropriate vegetation buffer along the outside of the boundary as well, as described previously. Clearly, this vegetated buffer will take up to 5 years to reach a height to be fully effective in interception of spray drift.

Based on the research cited, a 1.8 m high colorbond fence behind each lot – presenting a hard barrier – is likely to intercept up to 50 % of the low-level spray drift in the proposed new development. The vegetation buffer planted outside their immediate boundary fence to the prescription developed from research outlined above, will eventually reduce low-level spray drift by up to 90 %.

It should be noted that with a hard fence barrier, and certainly when the vegetated barrier bordering each lot has become well established, any spray drift is likely to be projected upward and significantly further downwind.

However, the most important factor in the likelihood of spray drift across the proposed subdivision is the behaviour of vineyard operators and the types of equipment that they utilise. While agricultural operators have a legal obligation to mitigate harmful off-site impacts, the vineyard managers should be adhering to best management practice in vineyard management and spraying, e.g. that they utilise an appropriate sprayer to minimise spray drift (i.e. a Tunnel and Recycle sprayer with coarser spray heads), maintain excellent canopy management to minimise disease and pest issues to reduce the number of sprays, utilise experience operators and appropriately calibrate their equipment, travel at the lowest possible speeds, and operate in appropriate environmental conditions to minimise spray drift.

A formal agreement or memorandum of understanding should be sought with the vineyard operator in regard to these matters.

The research indicates that the combination of a hard barrier and a vegetated barrier, and the adherence of the vineyard operator to best practice management along with the use of the most appropriate spraying unit, reduces the potential for significant spray drift occurring across the proposed subdivision to a very low level.

Should you seek clarification or any further comment on this Memorandum, please contact me according to any of the means outlined below.

S. Hamilton

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Personal communication

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