

TECHNICAL MEMORANDUM

Water Use Estimates for Purple Wine + Spirits, Graton Facility

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Prepared For: Purple Wine + Spirits

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1.0 INTRODUCTION

Purple Wine + Spirits (CLIENT) proposes to reduce on-site wine and spirits production by 1.5 million cases and add a crush pad with approval to crush up to 10,000 tons of grapes per annual harvest season. As was approved in earlier permits, the CLIENT wishes to preserve its ability to flex between wine and spirits production within a combined case limit. That limit, currently 3 million cases of total production output per year, would be lowered to 1.5 million cases per year under this proposed project. The CLIENT also brings bulk wine and bulk spirits onto the site to age, bottle, or blend with other products under its current permits. These processes would also be subject to the new 1.5 million case limit of wine and/or spirits produced at the facility.

The CLIENT has asked LACO Associates (LACO) to provide estimates of current water use, water use by production type, and projected water use for several scenarios under the proposed permit.

2.0 ANALYSIS

2.1 Assumptions

LACO has made comparisons based on the volume of water used per volume of wine or spirits processed or produced, reported in gal/gal or L/L. In the wine industry, this metric can be referenced as the Wine Institute's *Water Conservation Ratio*. In the spirits industry and more broadly, this metric can be referenced as the Beverage Industry Environmental Roundtable's (BIER) *Water Usage Ratio*.

As many values reported in the industry are given in terms of volumes of water required per volume of wine or spirits processed, we have converted cases to gallons with the following assumptions. A case of wine or spirits was taken to be 12 bottles of 750 mL each, or 9 L, or 2.378 gallons. If the facility processes meaningful volumes of dessert wines, half-bottles, or splits, there may be adjustments required.

Finally, the analysis requires estimating the amount of wine produced by 10,000 tons of grapes. Chris Gerling (Cornell) gives this conversion factor as 150 gallons of wine per ton of grapes (between 120 and 180 under normal conditions). Daniel Sumner (Davis) takes the factor as 170 gallons of wine per ton of grapes for California. An analysis done for Wild Diamond Vineyards relied on a ratio of 165 gallons wine per ton of grapes. We have similarly taken this value to be **165 gallons of wine per ton of grapes in our estimates**. In the context of a permit specifying quantities of grapes, this higher value provides a conservative estimate for water use. While we arrived at this value independently, it is consistent with the number used by Jim Neely, Facility Manager for the CLIENT's Olivet crush site. At this rate, the proposed **10,000 tons of grapes would yield 1,650,000 gallons of wine or 694,000 cases of wine**.

2.2 Definitions

Currently, the Graton facility does not crush grapes as a part of their production of wine. The crushing of grapes occurs off-site and the juice is delivered as bulk wine to the Graton facility where it is processed and bottled. In this memo, the **grape-to-bulk wine** will refer to crushing of grapes as currently occurs outside the Graton facility. **Bulk-to-bottle wine** will refer to processing and bottling of bulk wine, as currently occurs at the Graton facility. **Grape-to-bottle wine** will refer to wine processing that includes both grape-to-bulk and bulk-to-bottle processes.

Similarly, **bulk-to-bottle spirits** will refer to aging and bottling of spirits brought to the Graton facility post-distillation. **Grain-to-bulk spirits** will refer to distillation and/or infusion processes performed prior to aging of spirits. **Grain-to-bottle spirits** will refer to spirits processing that includes both grain-to-bulk and bulk-to-bottle processes.

2.3 Current Well Water Use

Based on data retrieved from the State Water Resources Control Board, Division of Drinking Water (Drinking Water Information Clearinghouse), we evaluated well water use for the five years in which full-year data was available (2013-2107). Over this period, well water use varied from 5.197 million gallons in 2015 to 6.796 million gallons in 2016, with an **average well water use of 6.242 million gallons per year**. This usage rate was taken as the baseline average for this evaluation. We note it is not the maximum historical usage rate.

2.4 Water Use Ratio for Bulk-to-Bottle Wine at Graton

Based on water use data referenced above and production data supplied by the CLIENT, we evaluated quantity of well water used per quantity of bulk-to-bottle wine produced for the same five-year period (2013-2107). Over this period, the water use ratio varied from 0.86 gal/gal in 2013 to 1.37 gal/gal in 2016, with a value of **1.01 gallons well water used per gallon of bulk-to-bottle wine produced** for the whole five-year period. We take this as a baseline for bulk-to-bottle wine production at the Graton facility.

2.5 Water Use Ratio for Grape-to-Bulk Wine at Graton

Currently, the CLIENT conducts grape-to-bulk operations at their Olivet site, and the juice is sent to the Graton facility for bulk-to-bottle operations. Based on calculations by Always Engineering, grape-to-bulk operations at the CLIENT's Olivet site produce 2.47 gallons of process wastewater produced per gallon of grape-to-bulk wine. We expect similar numbers for water use, as no water enters or exits the product in grape-to-bulk operations and, thus, almost all water used becomes wastewater produced. Evaporative losses, estimated at 1 percent of water used, represent the only discrepancy. We, therefore, estimate **2.49 gallons well water used per gallon of grape-to-bulk wine processed.**

As grape-to-bottle processes include both grape-to-bulk processes and bulk-to-bottle processes, the water use ratio for grape-to-bottle processes is the sum of their respective water use ratios: $2.49 + 1.01 = 3.50$ **gallons water used per gal of grape-to-bottle wine produced.** This estimate is well within typical ranges for large wineries.¹

2.6 Water Use Ratio for Grain-to-Bulk Spirits at the Graton Facility

The Graton facility currently produces grain spirits (whiskey, bourbon, rye), non-grain spirits (gin, vodka), and purchases bulk spirits (whiskey, gin, vodka). Our initial grain-to-bulk spirits analysis focused on whiskey as it typically requires more water than other spirits. To capture water use ratios for whiskey production at the Graton facility, we identified all water paths for the process and estimated the flows per production day, based on data from the CLIENT and on-site evaluation. These estimated water flows are summarized in the attached figure (Figure 1). Based on this analysis, we estimate the Graton facility water use ratio at **7.25-gallons water used per gallon grain-to-bulk spirits produced** with current equipment and processes.

As there is currently no on-site malting of barley, this value can be applied to similarly-produced spirits (bourbon, rye, vodka). This can also be taken as a conservative estimate for the infusion processes used in spirits like gin. The use of closed-loop glycol cooling systems makes their process particularly efficient with respect to water.²

¹ Larger processing facilities typically observe lower water use ratios. Based on production volumes, the Graton facility is classified as large, according to industry standard metrics provided by Wines & Vines. Sumner estimates large sized wineries to have a ratio of 3 gal/gal. Thoet, et al. studied seven wineries in practice making specific efforts to reduce water usage and found 1 with a ratio below 2.0, 3 between 2.0 and 2.9, and 3 above 2.9, suggesting a median near 2.9 for wineries making such efforts. Gallo wineries has publicly disclosed a goal of reaching 4.0 gal/gal, while Wild Diamond Vineyards uses a ratio of 6.0 in their planning. The Winery Process Handbook takes their example winery with a ratio that has been reduced from 9 to 6, but with a goal of 3. Finally, the 2016 BIER report lists the aggregate ratio for established wineries at 3.81, based on 69 total wineries in 2015.

² While water use for distilleries is well understood, the absolute range of water use ratios is more variable than for wineries. The 2012 BIER report surveyed 80 distilleries and found an aggregate water use ratio of 34.55, but with a range from 7.87 to 126.32 in 2011. The 2016 BIER report includes data from 106 distilleries and reports aggregate water use of 39.04, but with a range from 9.04 to 128.40 for 2015. This range can be compared, for example, with 2.86-6.07 for 235 breweries or 1.44-3.58 for 718 carbonated soft drink facilities. The large range and potential for high ratios in distilleries motivated our analysis of current distilling practices at the Graton facility.

2.7 Water Use Ratio for Bulk-to-Bottle Spirits at the Graton Facility

Based on CLIENT assertion, water use ratios for bulk-to-bottle spirits are similar to that for bulk-to-bottle wine, or **1.01 gallons well water used per gallon of bulk-to-bottle spirits produced**. Indeed, this may be a conservative assumption given (1) wine bottles are rinsed with water and spirits bottles are rinsed with product, (2) barrels used for aging bourbon are not rinsed between uses as bourbon requires single-use barrels, and (3) bottle proofing water use is minimal. We estimate a water-use-ratio specific to bulk-to-bottle whiskey production at 0.36 gallons well water used per gallon of bulk-to-bottle whiskey produced, well below the broader estimate.

3.0 CAPACITY ESTIMATES

3.1 Production Levels with Equivalent Water Use

Based on our estimated water use ratios for each purpose and our identified average baseline water use of 6.242 million gallons per year, the baseline well water withdrawal could support at least the following levels of production:

- a) 2.60 million cases of bulk-to-bottle wine or spirits, comparable with current use; or,
- b) 1.05 million cases of grape-to-bulk wine, consistent with 15,200 tons of grapes; or,
- c) 362 thousand cases of grain-to-bulk spirits; or,
- d) Proportional combinations thereof.

3.2 Water-Equivalent Production

The CLIENT intends to fluctuate the various types of production over time, and different process types have different water requirements. For the facility to vary process types without impacting water use, it will need to reduce levels of one process type as it increases levels of another process type. Therefore, we identified the following pairs of process levels with equivalent water requirements. These process volumes could be exchanged without affecting total water demand.

- 7.18 gallons bulk-to-bottle wine or spirits \approx 1 gallon of grain-to-bulk spirits,
- 2.46 gallons bulk-to-bottle wine or spirits \approx 1 gallon of grape-to-bulk wine,
- 2.91 gallons grape-to-bulk wine \approx 1 gallon of grain-to-bulk spirits.

These were obtained by dividing the water use ratio for the more water-intensive process by the water use ratio for the less water-intensive process.

4.0 REFERENCES

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- Sustainable Winegrowing British Columbia. *Winery Process Wastewater Management Handbook*, 2018.
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- Wines & Vines. Wine Industry Metrics: September 2018 Metrics. Retrieved from <https://www.winesandvines.com/template.cfm?section=widc&widcDomain=wineries>

FIGURES

Figure 1

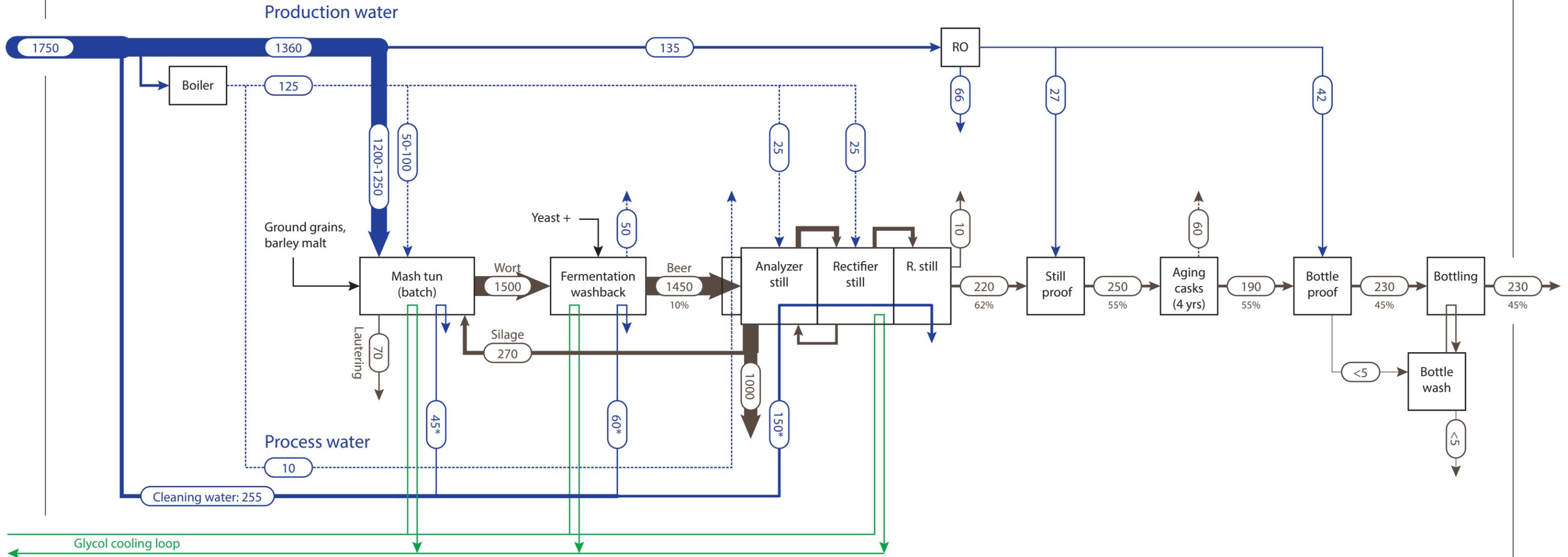
Estimated Water Flows

Estimated Water Flows for Whiskey Production

Graton Distilling Facility

All estimates are in gallons per production day.

Distilling occurs 4 days/week, 48 weeks/year.



* Cleaning processes include water used per production day and prorated water used per weekly cleaning.

