APPENDIX A

CALCULATING WATER INVENTORIES - EXAMPLES

When filling out Worksheet 2-1 (Inventories for Water Use) or creating your own worksheet, include all the activities you checked in Data Collection Sheet #2. Below are some example calculations. You should perform similar calculations for all activies identified in Data Collections Sheet #2. See the Cooper-Garrod Case Study for example.

1. BARREL CLEANING AND SANITATION – INTERIOR OF BARREL:

a. Wineries with a Barrel Washing Machine

CLEANING/SANITIZING THE BARREL WASHING MACHINE

	YEAR ROUND TOPPING SETUP *(gallons per setup)*	HARVEST RACKING SET-UP *(gallons per setup)*
CAUSTIC	50	100
PAA	50	100
RINSE	50	100
TOTAL GALLONS PER SET-UP	150	300
SET UP PER YEAR	30	30
Total gallons per year	**4,500**	**9,000**

Use the appropriate gallons for your winery

CLEANING/SANITIZING THE INTERIOR OF BARRELS WITH A BARREL WASHING MACHINE:

FLOW RATE (GALLONS PER MINUTE)	5
TOTAL MINUTES PER BARREL - COLD RINSE, HOT CLEAN, RINSE/SANITIZE	12
TOTAL GALLONS PER BARREL (TOTAL TIME X FLOW RATE)	60
NUMBER OF BARREL WASHING PER YEAR	500
Total gallons per year	**3,000**

Total Water Use Associated with Using a Barrel Washing Machine = 4,500 + 9,000 + 3,000 = 16,500 gallons per year

Note: confirm the flow rate (gallons per minute) at your facility as well as the total time based on your standard operating procedures (SOPs)

b. Wineries Without a Barrel Washing Machine - Spray Ball at the End of a Hose Wand:

FLOW RATE (GALLONS PER MINUTE)	8
TOTAL MINUTES PER BARREL - COLD RINSE, HOT CLEAN, RINSE/SANITIZE	15
TOTAL GALLONS PER BARREL (TOTAL TIME X FLOW RATE)	120
NUMBER OF BARREL WASHING PER YEAR	500
Total Gallons per Year	**60,000**

Use the appropriate gallons for your winery

See water use rates for typical equipment and hoses (following 2 pages)

Total Water Use Associated with a Spray Ball = 60,000 gallons per year

2. OTHER ACTIVITIES ASSOCIATED WITH A BARREL PROGRAM:

a. Barrel Testing

GALLONS PER BARREL	65
NUMBER OF BARRELS TESTED PER YEAR	50
Total Gallons per Year	**3,250**

Use the appropriate gallons for your winery

b. Barrel washing – exterior

GALLONS PER BARREL	.25
NUMBER OF BARRELS TESTED PER YEAR	500
Total Gallons per Year	**125**

c. Maintaining Empty Barrels

FLOW RATE (GALLONS PER MINUTE)	8
TOTAL MINUTES PER BARREL	4
TOTAL GALLONS PER BARREL (TOTAL TIME X FLOW RATE)	32
NUMBER OF BARRELS PER YEAR	100
Total Gallons per Year	**3,200**

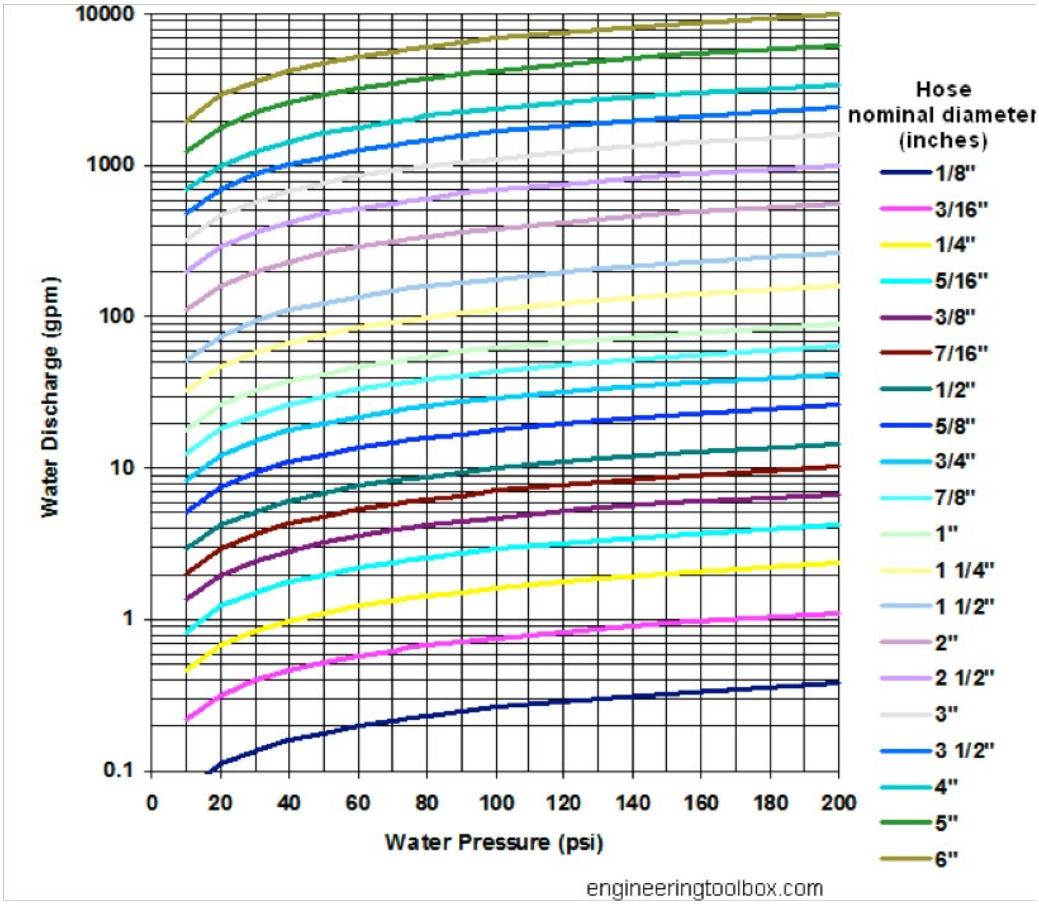
REFERENCE WATER USE RATES FOR TYPICAL EQUIPMENT

Use the reference table below and the figure on the following pages to estimate flow rates for various equipment and activities in your facility. Again, this information can be used when filling out Worksheet 2-1 (inventories for water use) or creating your own worksheet.

APPLICATION	EQUIPMENT	SERVICE PRESSURE (PSI)	FLOW RATE (GPM)	WASH CYCLE (MINS)
Cleaning unit	Gamajet IV	20 - 500	30 - 320	3 - 30
Cleaning unit	Gamajet V (fluid-driven)	50 - 1,200	6.7 - 42	3 - 33
Cleaning unit	Gamajet VI (non-lub'd)	10 - 700	5 - 40	10
Cleaning unit	Gamajet Barrel Blaster	50 - 1500	2 – 8	2 - 5
Spray gun	Straham S-70 Nozzle	50 – 80	5 – 7	n/a
Spray gun	Straham S-70 Nozzle	100	10	n/a
Pressure wash	Hotsy BD cold	3,500 - 5,000	3.7 - 4.5	n/a
Pressure wash	Hotsy BX cold	2,000 - 3,500	2.8 - 3.7	n/a
Pressure wash	Hotsy EP cold	1,000 - 2,000	3 - 3.5	n/a
Pressure wash	Hotsy 1400 hot	3,000	3.9	n/a
Pressure wash	Hotsy 500 hot	1,000 - 1,500	2.1 - 3.0	n/a
Pressure wash	Hotsy 700 hot	1,500 - 2,000	2.8 - 3.5	n/a
Pressure wash	Hotsy 900 hot	2,000 - 2,300	3.8 - 3.9	n/a
Power wash	Hydrotek CW21004E3	2,100	4	n/a
Pressure wash	Kew 7- 66	2,750	5.5	n/a
Hot water	Aaqua Tools HotCart	n/a	13.2	n/a

Source: The Comprehensive Guide to Sustainable Management of Winery Water and Associated Energy available at: http://www.wineinstitute.org/winerywaterguide

REFERENCE WATER DISCHARGE THROUGH 100 FEET OF HOSE:



The diagram above shows water flow through 100 feet of hose. If your hose is less than 100 feet in length, you will have less friction loss and therefore your flow rate will increase. However, the estimated flows in the diagram can be used for estimating purposes.

If you want to determine the actual flow rate (gallons per minute) of your equipment, we recommend you use an (1) empty tank with a known volume and (2) a stop watch. Put the hose in the tank, start your stop watch while turning the hose on and fill the tank with water (or to a known volume) and stop the watch. Record the time to fill the tank. Divide the known volume of the water in the tank by the time it took to fill it and that represents your flow rate.

A tank rather than a barrel is recommended as the flow rate from a ½-inch hose varies from 1.2 gallons per minute to almost 15 gallons per minute depending on the pressure. You want to make sure you have a container that can hold the maximum volume estimated in the figure above.

REFERENCE WATER CONTENT IN ONE FOOT OF PIPE (FOR PUSHING WINE/MUST/JUICE WITH WATER):

	WATER CONTENT (PER FT. PIPE)		
NOMINAL PIPE SIZE (IN)	VOLUME (CU. IN)	VOLUME (GALLONS)	WEIGHT (LBS.)
1/4	0.59	0.003	0.02
3/8	1.33	0.006	0.05
1/2	2.36	0.010	0.09
3/4	5.30	0.023	0.19
1	9.43	0.041	0.34
1 1/4	14.7	0.064	0.53
1 1/2	21.2	0.092	0.77
2	37.7	0.163	1.36
2 1/2	58.9	0.255	2.13
3	84.8	0.367	2.31
4	150.8	0.653	5.44
5	235.6	1.02	8.50
6	339.3	1.47	12.2
8	603.2	2-61	21.8
10	942.5	4.08	34.0
12	1357.2	5.88	49.0
15	2120.6	9.18	76.5

The chart above shows water volume in one foot of a pipe. For example, pushing wine with water through a 4 inch pipe/hose for 40 feet would equate to 0.653 gallons of water per foot, or a total of 26 gallons. If you do this task 100 times over the course of a year that would indicate that approximately 2,600 gallons of water is used to move wine.

Source: http://www.engineeringtoolbox.com/pipe-water-content-volume-weight-d_1734.html

FACILITY WATER BALANCE:

You may end up with an estimated Facility Water Balance. The facility water balance will show you relative percentages and help you identify your 'hot spots.' Hot spots represent your best opportunities for improving water use efficiency. Typically a few activities may represent a large portion of total use as shown in the example table below.

EXAMPLE FACILITY WATER BALANCES	EXAMPLE WINERY #1	EXAMPLE WINERY #2
GENERAL PRESS SANITATION	2 %	4 %
WINE PUSHING / LINE SANITATION	28 %	17 %
TANK SANITATION	15 %	14 %
BARREL CLEANING	21 %	17 %
CROSS-FLOW SANITATION	16 %	13 %
BOTTLING LINE STERILIZATION	6 %	15 %
VACUUM PUMPS	--	9 %
Total	**85+%**	**85+ %**

Percentages vary depending on the winery operations, equipment and standard operating procedures. Also, see Case Studies in Appendix B to read how those wineries developed their Facility Water Balance.

Source: http://www.engineeringtoolbox.com/pipe-water-content-volume-weight-d_1734.html

APPENDIX B
CASE STUDIES

COOPER-GARROD CASE STUDY

Cooper-Garrod is a family owned and operated 28-acre estate vineyard and winery located above the village of Saratoga on unirrigated hillsides in the Santa Cruz Mountains AVA. Typical yield is approximately 75 tons of fruit of which 45-50 are processed and aged onsite and ultimately bottled by a mobile bottling company. An adjoining tasting room is open daily and hosts about 8,000 visitors a year. Other activities that impact metered water usage include horse events that draw up to 2,000 guests a year. Process water, domestic waste, and some storm water is treated onsite via septic system and leach field.

In 2012, the Mount Eden Mutual Water Company provided 69,190 gallons of water to the winery and tasting room through a single metered connection. The 2012 water usage was a surprising 20% increase over the previous two years.

In response, Bill and his nephew, Ben Cooper, followed the Handbook steps as summarized below:

STEP 1 PLANNING AND ORGANIZATION *(SET GOALS)*:

- Identify the largest water using activities
- Determine if water is used as efficiently as possible

STEP 2 ASSESSMENT *(COMPILE DATA):*

- Translate written Standard Operating Procedure (SOP) into an Excel spreadsheet
- Identify water-using activities not included in SOP
- Estimate annual gallons water used per activity

STEP 3 DATA EVALUATION *(IDENTIFY HOTSPOTS):*

- Develop a Facility Water Balance (FWB) (see table below)
- Identify largest water uses:
  (1) Press cleaning/sanitation
  (2) Barrel cleaning/sanitation
  (3) Tasting room
- Identify data gaps that need to be filled

STEP 4 OPTION IDENTIFICATION *(CLOSE DATA GAPS):*

- Improve Facility Water Balance by identifying 'unaccounted' water use:
  (1) Read meter before and after when water is used on the crush pad or in cellar
  (2) Read meter before and after bottling line operations
  (3) Identify water usage when winery is not using water, i.e., meter is spinning, but winery is not using water.
- Refine and incorporate estimated task times directly into the SOPs
- Use improved Facility Water Balance to forecast seasonal or monthly usage

Step 2 appeared relatively straight-forward as Cooper-Garrod had written a Cleaning and Sanitation SOP for their organic certification and only had to identify other water usage, then calculate water required for the various steps and their frequency of occurrence.

About three hours later, at the end of Step 3, they had developed an estimated Facility Water Balance (below). Because the estimate of non-winery water use is fairly accurate, if not conservative, the Coopers could approximate the volume of water the winery used in 2012 (69,190 – 6,000 = 63,190 gallons) and the ratio of water used to gallons of wine bottled (approximately 8.6). A ratio below 9 is reasonable for a winery of this size, and their success can be attributed to existing best practices including:

- Pre-cleaning crush equipment and tanks with brush or scraper
- Recycling ozone rinse water when feasible
- Using a pig to help clean hoses
- Using a pressure washer or other flow control devices during cleaning and sanitizing activities

However, Cooper-Garrod is interested in further improving their water efficiency. Because the Facility Water Balance (below) currently sums to about half the metered total, most of the next steps involve closing data gaps and improving the understanding of where metered water is used in, and outside, the winery. By identifying the unaccounted flows, Cooper-Garrod will be able to confirm which activities use the most water, and then tailor the next water conservation initiatives to address the largest water-using activities.

Cooper-Garrod will be able to improve their water-to-wine ratio in the coming years.

CLEANING AND SANITATION ACTIVITIES	ESTIMATED ANNUAL GALLONS	PERCENT OF ESTIMATE	ALLOCATED GALLONS
PRESS	6,527	19%	13,187
BARRELS	5,130	15%	10,364
PUMPS, HOSES, VALVES, GASKETS	4,720	14%	9,536
DESTEMMER	2,882	8%	5,823
TANKS	2,170	6%	4,384
KEGS, CARBOYS AND GLASS JUGS	1,800	5%	3,637
PLATE AND FRAME FILTER	1,275	4%	2,576
BOTTLING	900	3%	1,818
BOTTLING TANK CLEANING	868	3%	1,754
DUMPING STAND	815	2%	1,647
HARVEST BINS	583	2%	1,178
HAND TOOLS	78	0.2%	158
Other Winery Activities			-
LAB	300	0.9%	606
BARREL TESTING	100	0.3%	202
CHILLER	100	0.3%	202
Non Winery Activities			-
SINKS - TASTING ROOM AND HORSE OWNERS	6,000	17.5%	12,122
Total Estmated Water Use	**34,247**		-
METERED GALLONS *	69,190		69,192

** Water supply for the employee and guest bathrooms as well as some small water features and minor landscape irrigation is supplied from a separate water meter and therefore not included in this work.*

BENEFITS FROM WORKING THE STEPS:

Bill Cooper anticipates experiencing additional benefits from his proactive approach of measuring and managing water use at the winery.

Shortly after completing the Facility Water Balance shown above, and in response to a 2011 Santa Clara County study to recommend how the county could better support local wineries, the County created a "Limited Food Service for Wineries" license to bridge the gap between tasting room crackers and a full-service kitchen. As a first step, the license required an evaluation (below) of the 1993 septic system that was installed to support the tasting room and a 6,000 case winery (the winery currently produces 2,500-3,000 cases per year). Much of the information collected as part of the Facility Water Balance process will be useful in responding to the County's request for information.

The County required the following information as part of the septic system evaluation:

THE FOLLOWING QUESTIONS WILL HELP US ASSIST YOU IN EVALUATING THE WASTEWATER FLOW OF THE ONSITE SEWAGE DISPOSAL SYSTEM.
Existing House
NUMBER OF BEDROOMS IN EXISTING HOUSE ON SITE.
Wine Making
IS WINEMAKING OPERATION SEASONAL OR YEAR ROUND.
IF SEASONAL, WHAT IS THE SEASON?
AVERAGE GALLONS OF WASTE WATER PER DAY USED DURING WINE MAKING?
AVERAGE NUMBER OF WINE TASTING CUSTOMERS PER WEEK?
Horse Activities (boarder, shows, special events)
OCTOBER-MARCH
AVERAGE NUMBER OF PEOPLE ONSITE EACH WEEKDAY?
AVERAGE NUMBER OF PEOPLE ONSITE EACH WEEKEND?
APRIL-SEPTEMBER
AVERAGE NUMBER OF PEOPLE ONSITE EACH WEEKDAY?
AVERAGE NUMBER OF PEOPLE ONSITE EACH WEEKEND?
Overall-Winery and Farm
NUMBER OF EMPLOYEES-WEEK DAYS?
NUMBER OF EMPLOYEES-WEEKENDS?
ARE THERE OTHER RESTROOMS FOR PUBLIC USE, OR ANY CHEMICAL TOILETS BROUGHT IN FOR SPECIAL EVENTS?
IS THE HORSE WASH PAD CONNECTED TO SEPTIC SYSTEM?
Please feel free to provide any additional information.

Looking ahead, if the Mutual Water Company asks its customers to consider voluntary reduction in water use in the future, Cooper-Garrod could use the Facility Water Balance and the ongoing measuring and management activities to demonstrate that the winery has already reduced water use and had achieved appropriate levels of water conservation.