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Wastewater Feasibility Study

Envy Wines Winery
Major Modification P18-00071-MOD & RSS Exception
Planning Commission Hearing Date – October 16, 2019

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WASTEWATER FEASIBILITY REPORT

FOR THE

ENVY WINES
USE PERMIT MODIFICATION

PROJECT LOCATED AT

1170 TUBBS LANE
CALISTOGA, CA 94515

COUNTY: NAPA
APN: 017-210-027

February 14, 2018

PREPARED FOR REVIEW BY:

NAPA COUNTY DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
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I. INTRODUCTION

Envy Wines is requesting a Use Permit Modification to increase wine production from 50,000 gallons to 100,000 gallons per year on an 18.76-acre parcel located at 1170 Tubbs Lane. No changes to existing marketing plan are proposed, and no changes to existing buildings or parking areas are proposed. Other improvements include widening the existing driveway to meet Napa County Road & Street Standards.

This report has been prepared to evaluate the feasibility of using the existing process wastewater ponds to accommodate additional winery process wastewater.

II. WINERY DOMESTIC WASTEWATER FLOW

A. Wastewater Generation

The domestic wastewater (DW) generated at Envy Wines is dependent on the daily number of employees and visitors present at the winery. The marketing plan, as described below, determines the maximum number of guests the winery is permitted to serve in one day, as well as the maximum number of permanent employees that the winery needs to functionally operate. In terms of wastewater generation, this gives the maximum number of people that will be contributing to the daily peak wastewater flow rate.

B. Estimating Wastewater Quantity

To calculate the daily peak DW flow rates generated at Envy Wines, the maximum number of people present at the site, as well as the amount of wastewater each person will generate, must be estimated. The marketing plan acknowledges a total of 2 full-time and 2 part-time employees and up to 30 daily visitors on weekdays and/or weekend days. Napa County estimates the wastewater generated by visitors is 3 gallons per day per person, and 15 gallons per day per employee[1].

The peak effluent generated in a day will occur when the winery requires all employees on staff, receives the maximum number (30) of visitors a single day, and has a special event for up to 50 visitors. *Based on this combination, the peak daily domestic wastewater flow is 330 gallons per day* (see **Table 1**, below). For design purposes, this shall be taken as the daily flow considered for storage and treatment requirements.

[1] Napa County Regulations for Design, Construction, and Installation of Alternative Sewage Treatment Systems, Appendix 1, Table 4, 2006.

Source	Number	Projected Flow (gpd)	Total Flow No Event Day (gpd)	Total Flow Event Day (gpd)
Full-time employees	2	15	30	30
Part-Time/Harvest employees	2	15	30	30
Visitors (30 weekday/weekend)	30	3	90	90
Private Event*	50	3	0	150
Event Staff	2	15	0	30
Grand Total		**Total Peak Flow**	**150**	**330**

*Events for more than 50 people shall use portable toilets

Table 1: Total Domestic Wastewater Flows

C. Estimating Wastewater Quality

The quality of domestic wastewater generated at a winery is similar to wastewater generated from a residence. The main effluent quality parameters that must be estimated from a winery's wastewater are the 5-day Biochemical Oxygen Demand (BOD5) and the Total Suspended Solids (TSS). The BOD5 concentration is a measurement used to estimate the amount organic matter present in wastewater. The TSS concentration is a measure of solid particles that have not yet settled out of the wastewater. Several additional wastewater constituents must also be estimated, as they have a direct correlation with the treatment processes used to reduce BOD5 and TSS concentrations. Fats, oils, and grease (FOG) will likely be discharged to the sewer system, and can damage the biological processes that take place in wastewater treatment. The total dissolved solids (TDS) present in wastewater can be an indicator for cleaning agents, which can affect the pH balance and destroy the bacteria that reduce organic matter in wastewater. The pH value affects bacteria that consume organic matter in the wastewater. The dissolved oxygen (DO) level can tell wastewater treatment operators that the bacteria need more or less oxygen in order to consume and reduce organic matter present in the wastewater. In addition to oxygen, bacteria need nitrogen to fuel their consumption of organic matter. The total nitrogen concentration in wastewater will alert wastewater treatment operators to how much nitrogen they need to add to the wastewater in order for bacteria to most efficiently consume organic matter. If a high level of wastewater treatment is required, it is important to know the type and amount of harmful bacteria and pathogens that are present in the effluent so the most appropriate form of disinfection can be applied. In domestic wastewater, fecal coliform is extremely prevalent, and is detrimental to human health. **Table 2** provides a description of the expected strength of each wastewater constituent.

Constituent	Unit	Domestic
FOG	Mg/L	31-164
BOD5	Mg/L	110-400
TSS	Mg/L	100-350
TDS	Mg/L	280-850
Nitrogen (total as N)	Mg/L	20-85
Total Coliform	MPN/100 mL	10^7-10^8
Fecal Coliform	MPN/100 mL	10^4-10^5

Table 2: Typical Domestic Wastewater Values

III. WINERY PROCESS WASTEWATER FLOW

A. Production Methods

Winery wastewater outflow and strength varies throughout the winemaking year. A typical winemaking year begins with harvest preparation and harvest. These events occur during the months of August, September, and October. The harvest season typically generates both the largest volume and maximum strength of process wastewater. A breakdown of the different winemaking phases are detailed below.

Harvest and Crush – As previously mentioned, a winery will harvest and crush its fruit during the months of August, September, and October. Once the grapes have reached maturity, the fruit will be separated from the stems, and crushed to collect the juice for fermentation. Floor drains typically collect the juice, stems, seeds, and skins that are washed off of the equipment in the crush process. Grate covers on the drains can prevent larger solids from entering the wastewater system, but seeds and skins can often enter the primary wastewater tank.

Fermentation – Juice from crush is collected and stored in tanks for fermentation. Yeast will be added to the juice in order for sugar to be converted to alcohol. The fermentation process can take anywhere from one to three weeks to complete. Once the fermentation process is complete, the wine will be drained from the tank into barrels for aging. Wine drained from the fermentation tanks will carry excess skins and seeds into the barrel. The remaining solids, known as pomace, will remain at the bottom of the tank. If desired by the winemaker, the pomace can be pressed to produce more wine with different characteristics for the blending process. The remaining solids will be disposed of at a solid waste facility. The empty fermentation tanks and pomace bins will be washed out with a combination of water and sodium hydroxide or potassium hydroxide. These additives can reduce the pH of the wastewater, and contribute to the total dissolved solids (TDS) concentration.

Clarification and Racking – Due to the excess grape skins and seeds carried over from the fermentation tanks, wine can have a high concentration of suspended solids directly after fermentation. These solids are called "lees" and are allowed to settle in the barrel during the aging process. To improve the clarity and quality of the wine, the liquid will be removed from the initial barrel, and placed in a new barrel that is free of settled solids. This process is called "racking" and will often occur several times through the wine aging process, which can last for several years. The first racking will most likely occur between the months of November and January. The lees that are washed out of barrels after the first racking are known as "gross lees." Gross lees represent the largest solid particles collected during the racking process. Responsible wineries will de-water the gross lees, and dispose of the solids off-site. However, lees are often washed out of barrels and allowed to drain to the process wastewater system due to their high water content. Wastewater generated from this process will typically have very high total suspended solids (TSS) content, and a very high biological oxygen demand (BOD). Additionally, tartaric acid can be added to the wine to adjust the acidity. Process wastewater generated by racking after pH treatment can negatively affect the natural biological treatment process in the primary wastewater tanks. As clarification and racking are part of the process used to "age" wine, it is possible for wastewater to be generated by this phase year round.

Filtering and Bottling - Wine that has reached the end of its aging process will be filtered and bottled. This process can occur throughout the year due to wine types aging at different rates and the winery's production schedule. The wine storage barrels will often be washed and reused. Equipment used for bottling will be washed on a daily basis. The wastewater strength at this stage of the wine making process is typically much lower than the previous three stages of winemaking.

B. Estimating Wastewater Quantity

As every individual winery incorporates differing winemaking methods and equipment, the actual annual wastewater produced varies for each winery. The amount of wine produced in one year is the most important part in estimating a specific winery's wastewater generation. Once a winery determines the volume of wine they will produce, various factors can be applied to estimate the wastewater that will be generated from production. Furthermore, it is very important to estimate the peak volume of wastewater that can be generated in one day. Undersized storage tanks and pumps can lead to the costly failure of wastewater treatment systems, and halt the production process. Two methods are currently used by the local wastewater engineering consultants to determine both the annual and daily peak process wastewater flows generated from a winery. The Napa County Method is used to estimate the peak wastewater flow that could occur in one day during harvest. The Industry Method estimates the annual wastewater generation, then distributes a percentage of that flow to each month based on the seasonal behaviors of winemaking. The daily peak flow is then estimated by dividing the volume of wastewater generated during the peak month by the number of days in the month. The Industry Method generally produces a more realistic estimate of wastewater flows. This report will analyze and compare both methods to determine the volume of process wastewater produced. The method that yields the most conservative (largest) estimate of wastewater flow will be used to estimate the quantity of wastewater generated at Envy Wines.

Napa County Method

The Napa County Method focuses on determining the maximum daily flow a wastewater system would be required to treat. This method uses two base assumptions: the amount of process wastewater generated annually is only distributed during harvest period, and a multiplication factor of 1.5 is used for process waste generation. The harvest period, shown in **Table 3** below, is divided into days that grapes are crushed based on annual production in order to obtain a flow rate in gallons per day (GPD).

Table 3: Napa Method: Crush Days

Annual Wine Production (gallons)	# of Crush Days
<20,000	30
20,000-50,000	45
>50,000	60

Based on the projected wine production (100,000 gallons), the multiplication factor (1.5), and the number of crush days (60) that wastewater generation is distributed over, the Napa County Method estimates a process wastewater (PW) peak harvest flow of **2,500 gallons per day** (see Appendix 1).

Industry Method

The Industry Method uses a ratio of 4-12 gallons of PW generated per gallon of finished wine produced to determine the annual PW volume produced. The ratio depends on the water conservation techniques utilized within each individual winery. In rare cases, if the winery is water conscious, the ratio can be as low as 4. For a typical winery, the ratio is higher. For Envy Wines, a value of 4 gallons of PW per gallon of wine is analyzed. The next step in estimating wastewater quantity is to determine the peak daily flow. The annual estimated PW is broken down into monthly percentage flows. This method attempts to consider the winery operations, which vary by month depending on the winemaking season. For example, with this method, the percentages increase for the harvest months and the percentages decrease for the non-harvest months.

Based on the annual wine production of 100,000 gallons of wine and 4 gallons of PW generated per gallon of wine, the Industry Method estimates 400,000 gallons of PW produced annually. **Table 4** shows the percentage breakdown for monthly and daily flows. This table is located in the 'Winery Process Wastewater Generation' page of the Water Balance Spreadsheet, found in **Appendix 1**.

PW Generation Table			
Month	% of Annual	Monthly Flow	Average Daily Flow
January	4.0%	16,000	516
February	6.0%	24,000	857
March	6.0%	24,000	774
April	4.5%	18,000	600
May	6.0%	24,000	774
June	7.0%	28,000	933
July	8.5%	34,000	1,097
August	10.0%	40,000	1,290
September	16.0%	64,000	**2,133**
October	14.0%	56,000	1,806
November	10.5%	42,000	1,400
December	7.5%	30,000	968
Total	**100.0%**	**400,000**	**1,096**

Table 4: Monthly Process Wastewater Flows

Based on Table 3 above, the peak daily process waste flow is **2,133 gallons per day**. Because the Napa County method of estimation yields a higher value of **2,500 gallons per day**, this peak value is used in the feasibility analysis for this report.

C. Estimating Wastewater Quality

The effluent strength parameters for all wineries vary throughout the year as different processes take place in each stage of the winemaking process. Furthermore, the strength of effluent at each individual winery can vary due to differences in the winemaker's technique and philosophy. The main effluent quality parameters that must be estimated from a winery's wastewater are the 5-day Biochemical Oxygen Demand (BOD5) and the Total Suspended Solids (TSS), as the concentrations of these constituents are regulated by both the Bay Area Water Quality Control Board and Napa County. The BOD5 concentration is a measurement used to estimate the amount organic matter present in wastewater. The typical BOD5 concentration of raw winery wastewater is 5,000 mg/L. The TSS concentration is a measure of solid particles that have not yet settled out of the wastewater.

Several additional wastewater constituents must also be estimated, as they have a direct correlation with the treatment processes used to reduce BOD5 and TSS concentrations. The total dissolved solids (TDS) present in wastewater can be an indicator for the amount of additives used to clean winery equipment, which can affect the pH balance and destroy the bacteria that reduce organic matter in wastewater. The pH value affects bacteria that consume organic matter in the wastewater. The dissolved oxygen (DO) level can tell wastewater treatment operators that the bacteria need more or less oxygen in order to consume and reduce organic matter present in the wastewater. In addition to oxygen, bacteria need nitrogen to fuel their consumption of organic matter. The nitrogen concentration in wastewater will alert wastewater treatment operators to how much nitrogen they need to add to the wastewater in order for bacteria to most efficiently consume organic matter. Fortunately, the presence of fecal coliform's and other pathogens are not detectable in process waste, and will not be considered a constituent of concern. The following table provides a range of the expected strength of each wastewater constituent throughout the winemaking year.

Table 5: Typical Process Wastewater Values

Constituent	**Unit**	Peak Season[a]	Off Season[b]
PH		3.8-7.8	3.8-7.8
BOD5	Mg/L	5,000	1,000
TSS	Mg/L	57-3,950	12-400
TDS	Mg/L	315-1,240	214-720
Nitrate	Mg/L	0.63-362	0.23-53
Ammonia	Mg/L	2.25	
D.O.	Mg/L	2.3-6.3	2.3-6.3

[a] Peak season runs from September through March

[b] Off season runs from April to August

IV. DOMESTIC WASTEWATER

Sterk Engineering completed a site evaluation in 2001 to locate suitable soils for a proposed wastewater dispersal area on the property. Plans for a pressure distribution system designed to serve up to 960 gallons per day were completed in 2001 by Sterk Engineering and approved by Napa County. This system was designed to treat and disperse both domestic and process wastewater. An additional site evaluation was completed in 2011 by Robertson Engineering, and provides test pits to support a reserve area on the parcel. The previous septic site evaluations and design documents denoting the test pit locations and soil findings can be found in **Appendix 2** of this report.

In 2011 Envy Wines requested and received approval for increased wine production of up to 50,000 gallons and Delta Consulting and Engineering designed a process wastewater pond system to treat all process wastewater and disperse it in the vineyard. This pond system was designed to accommodate process wastewater from up to 100,000 gallons of wine production.

The existing pressure distribution system has been used for domestic waste only since completion of the process wastewater ponds in 2015. It still has capacity to treat up to 960 gallons per day, and this project contemplates domestic wastewater up to a maximum of 330 gallons per day, well within the capacity of the existing pressure distribution system.

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V. PROCESS WASTEWATER

As described above, process wastewater for 50,000 gallons of wine production has been successfully treated in a 3-pond system designed by Delta Consulting & Engineering, and dispersed to approximately 2 acres of onsite vineyard as recycled water. The analysis below will show that the existing pond system can accommodate process wastewater from production of up to 100,000 gallons of wine.

A. Process Wastewater - Primary Treatment

Primary treatment provides partial removal of TSS and BOD through the gravitational settling of solids, as well as a small amount of biological treatment. Raw wastewater will flow via gravity from various sources throughout the site into a septic tank system. All septic tanks are to be equipped with an effluent filter. Within the septic tanks, solids will settle out of solution, and the remaining wastewater will continue to gravity flow to the next step of the treatment process. Detention time in the holding tank plays a large factor in reduction of TSS and BOD. In general, a longer detention time means more reduction of pollutants.

The strength of process wastewater is generally not reduced to the same extent as domestic wastewater. The reduction of BOD5 is typically below 30%, and depends on the detention time.

B. Process Wastewater - Secondary Treatment

The semi-treated effluent will enter into a secondary treatment, consisting of a pond system with three areas: a ~240,000 gallon aeration pond, a ~35,000 gallon settling pond, and a ~95,000 gallon storage and distribution pond. The BOD level shall be reduced by 95% to less than 50 mg/L and the TSS shall be reduced to less than 50 mg/L prior to being dispersed into the vineyard as recycled water.

C. Process Wastewater Disposal – Primary Area

The disposal area for the process wastewater is proposed to be located in a portion of the existing 11-acre vineyard. Please see Appendix 1 for a detailed breakdown of the irrigation calculations.

VI. CONCLUSION

Based on the analysis performed in this report, the Envy Wines Use Permit Modification is feasible with regard to wastewater disposal. The parcel contains suitable soils and adequate available dispersal area to support the project from a wastewater treatment perspective. Please see the Use Permit Plans for the proposed sizes and location of the primary and reserve areas for all the options described previously. Detailed calculations and construction plans will be submitted to the Napa County Department of Environmental Management for approval prior to the construction of the wastewater disposal system.

Following is a schematic of the existing process wastewater treatment system:

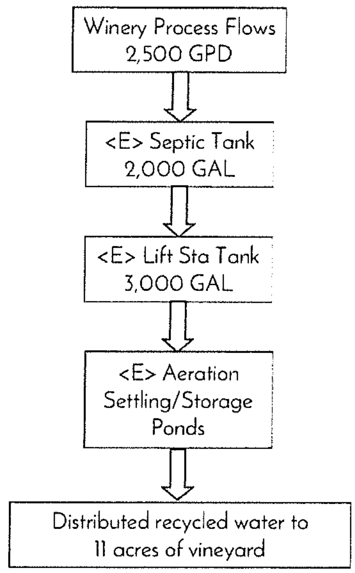

Figure 1: Process Wastewater Treatment System Schematic

D. Domestic Wastewater Reserve Areas

In the event a reserve area is required, suitable area has been identified on the Use Permit plans. Due to the limited depth of soil in the reserve, the recommended wastewater system type for the reserve area is a sub-surface drip engineered wastewater system. The application (infiltration) rate of the soil in this location for this system type is recommended to be 0.30 gallons per square foot per day. Using this application rate, we can calculate the required reserve area for domestic wastewater as follows:

$$square\ feet\ of\ reserve\ (200\%): \frac{330\ gpd}{0.30\ gal/ft^2} = 1{,}100\ ft^2\ \times 200\% = 2{,}200\ ft^2$$

Please see the Use Permit plans for a map showing the required 200% reserve area (approximately 14,000 square feet is available).

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IX. APPENDIX

1. Water Balance Calculations
2. Site Evaluation Report and As-Built Drawings

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APPENDIX 1:
WATER BALANCE CALCULATIONS

Project: Envy Wines
1170 Tubbs Lane
Calistoga, CA 94515
APN: 017-210-027

Project Description:
The following calculations are intended to estimate the process and domestic wastewater flows for Envy Wines.

Winery Process Wastewater Generation

Annual Wine Production	100,000	gallons
	2.4	gal/case
	41,667	cases
Wastewater Generation Rate	4	gal water/gal wine
Annual Process Wastewater	400,000	gal
Crush Length	60	days (<20k, 20k-50k, 50k+)
Wastewater Generation Rate (during crush)	1.5	gal water/gal wine
Daily Wine Production (during crush)	1,667	gal wine/day
Peak Daily Process Waste (County Method)	2,500	gal PW/day
Peak Daily Process Waste (Industry Estimation - see table below)	2,133	gal PW/day

PW Generation Table

Month	% of Annual	Monthly Flow	Average Daily Flow
January	4.0%	16,000	516
February	6.0%	24,000	857
March	6.0%	24,000	774
April	4.5%	18,000	600
May	6.0%	24,000	774
June	7.0%	28,000	933
July	8.5%	34,000	1,097
August	10.0%	40,000	1,290
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October	14.0%	56,000	1,806
November	10.5%	42,000	1,400
December	7.5%	30,000	968
Total	**100.0%**	**400,000**	**1,096**

Domestic Wastewater Generation

Source	Number	Projected Flow (gpd)	Total Flow No Event Day (gpd)	Total Flow Event Day (gpd)
Full-time employees	2	15	30	30
Part-Time/Harvest employees	2	15	30	30
Visitors (30 weekday/weekend)	30	3	90	90
Private Event*	50	3	0	150
Event Staff	2	15	0	30
Grand Total		**Total Peak Flow**	**150**	**330**

*Events for more than 50 people shall use portable toilets

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Aeration Pond Treatment Design (Partially-Mixed)

Design Criteria

	Influent			Effluent	
Peak Flow (Q)	2,500	gpd			
BOD_5	5,000	mg/L	BOD5	50	mg/L
TSS	300	mg/L	TSS	50	mg/L

	Maintained Volume (gal)	Hydraulic Retention Time (days)	BOD_5 (in)	BOD_5 (out)	
Pond (#01 - Aeration)	115,000	46	5,000	365	min HRT = 60 days
Pond (#02 - Settling)	5,000	2	365	235	max HRT = 2 days
Pond (#03 - Storage)	35,000	14	235	48	BOD_5 (out) <= 50
Totals	155,000	62			

Oxygen Requirement	1.5	lbs O_2/lb BOD
Oxygen Transfer Rate	1.8	lbs O_2/HP*hr

BOD_5 Mass Loading	105	lbs BOD5/day
Oxygen Requirements	6.6	lbs O2/hr
Aerator HP Required	3.6	HP
Aerator HP Available	8	HP

Power-to-Volume Ratio	0.52	HP/1,000 CF

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Pond Sizing Calculation (Pond #01 - Aeration)

Bottom Length	60	ft	Depth (maintained)	6.50	ft
Bottom Width	20	ft	Depth (maximum)	8	ft
Interior Side Slope	2	x:1	Depth (freeboard)	10	ft
Bottom Radius	0	ft	Vol (maintained)	117,513	gal
Top Radius	20	ft	Vol (maximum)	164,445	gal
Surface Area (maintained)	3,811	sf	Vol (freeboard)	240,772	gal
Surface Area (maximum)	4,564	sf			

Pond Sizing Calculation (Pond #02 - Settling)

Bottom Length	36	ft	Depth (maintained)	2.08	ft
Bottom Width	4	ft	Depth (maximum)	4	ft
Interior Side Slope	2	x:1	Depth (freeboard)	6	ft
Bottom Radius	0	ft	Vol (maintained)	5,111	gal
Top Radius	12	ft	Vol (maximum)	15,888	gal
Surface Area (maintained)	531	sf	Vol (freeboard)	34,773	gal
Surface Area (maximum)	985	sf			

Pond Sizing Calculation (Pond #03 - Storage) (Triangular)

Bottom Length	72	ft	Depth (maintained)	4.00	ft
Bottom Width	14	ft	Depth (maximum)	5	ft

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Historic Climate Data

Month	Average Temperature (°F)[1]	Average Rainfall[2]	100-Year Rainfall[3]	Pan Evaporation[4]	Lake Evaporation[5]	Evapo-transpiration (ETo)[6]
January	48.2	6.94	14.44	1.53	1.15	1.24
February	51.4	7.36	15.31	2.15	1.61	1.68
March	54.6	5.11	10.63	3.79	2.84	3.41
April	58.5	1.98	4.12	5.82	4.37	4.80
May	64.2	1.30	2.70	8.90	6.68	6.20
June	69.3	0.16	0.33	11.00	8.25	6.90
July	72.0	0.00	0.00	13.22	9.92	7.44
August	71.8	0.05	0.10	12.06	9.05	6.51
September	69.2	0.28	0.58	8.67	6.50	5.10
October	62.8	1.85	3.85	5.72	4.29	3.41
November	53.9	4.49	9.34	2.48	1.86	1.80
December	47.7	7.12	14.81	1.66	1.25	0.93
Total		36.64	76.21	77.00	57.75	49.42

[1]Monthly Normal Temps, St. Helena, 1981-2010, per NOAA (https://www.ncdc.noaa.gov/cdo-web/datatools/normals)
[2]Monthly Average Rainfall, St. Helena, 1981-2010, per NOAA (https://www.ncdc.noaa.gov/cdo-web/datatools/normals)

[3]2.08 multiplier created by ratio of peak to average at Napa State Hospital from 1893-2012 (https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?ca6074)
[4]Observed at Lake Berryessa from 1957-1970 (https://wrcc.dri.edu/htmlfiles/westevap.final.html#CALIFORNIA)
[5]Adjusted by a factor of 0.75 from Pan Evaporation
[6]ETo per CIMIS, Zone 8, Inland SF Bay Area (http://www.cimis.water.ca.gov/App_Themes/images/etozonemap.jpg)

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Irrigation Calculations

Vineyard Irrigation Parameters

Irrigated Vineyard	2.0	acres	Hourly Percolation Rate	1.27	in/hr (USDA ksat)
Row spacing	8.0	ft	Daily Percolation Rate	30.48	in/day
Vine spacing	4.0	ft	Safety Factor	0.04	
Total vine count	2,723		Adjusted Percolation Rate	1.22	in/day
Water Use (peak)	18	gal/vine/month			
Max Irrigation Demand	49,005	gal/peak month			
Max Irrigation Demand	0.90	inches/month			

Month	Process Waste (gal)	Reference ET (in)	Vineyard Crop Coefficient (Kc)	Vineyard ET (in)	100-Year Precipitation (in)	Irrigation (in)	Demand (gal)	Available Days per Month	Percolation (in)	Capacity (gal)	Effluent Applied (gal)
January	16,000	1.2	0.0	0.0	14.4	0.0	0	6	7.32	397,250	16,000
February	24,000	1.7	0.0	0.0	15.3	0.0	0	5	6.10	331,042	24,000
March	24,000	3.4	0.0	0.0	10.6	0.0	0	12	14.63	794,501	24,000
April	18,000	4.8	0.2	1.0	4.1	0.0	0	13	15.85	860,709	18,000
May	24,000	6.2	0.6	3.7	2.7	0.9	49,005	16	19.51	1,059,335	24,000
June	28,000	6.9	0.7	4.8	0.3	0.9	49,005	17	20.73	1,125,543	28,000
July	34,000	7.4	0.6	4.5	0.0	0.9	49,005	30	36.58	1,986,252	34,000
August	40,000	6.5	0.5	3.3	0.1	0.9	49,005	31	37.80	2,052,461	40,000
September	64,000	5.1	0.3	1.5	0.6	0.9	49,005	30	36.58	1,986,252	49,005
October	56,000	3.4	0.1	0.3	3.8	0.0	0	16	19.51	1,059,335	49,005
November	42,000	1.8	0.0	0.0	9.3	0.0	0	14	17.07	926,918	49,005
December	30,000	0.9	0.0	0.0	14.8	0.0	0	5	6.10	331,042	44,985
Total	400,000	49.4		19.1	76.2	4.5	245,025	195	237.7	12,910,640	400,000

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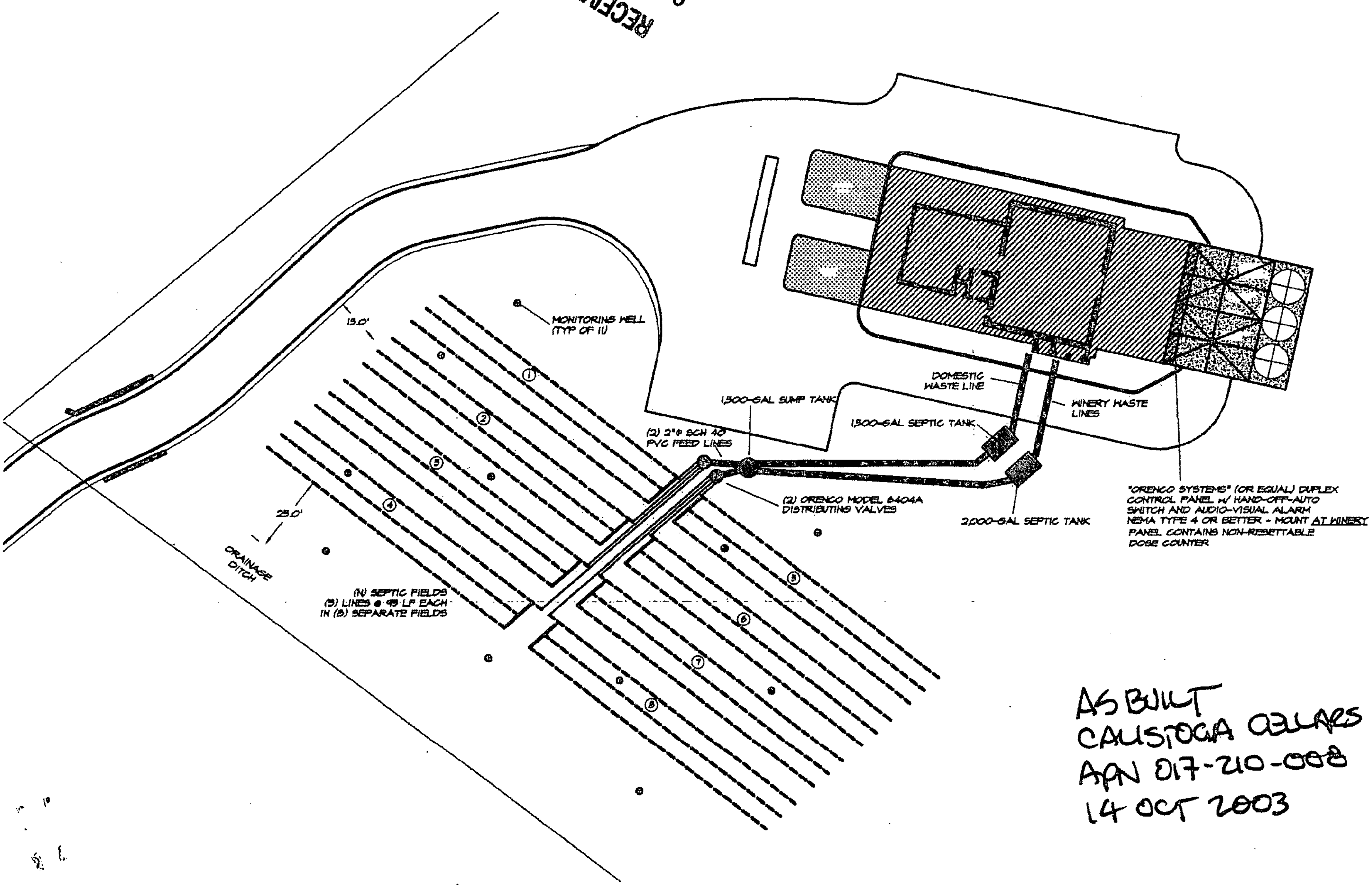
APN: 017-210-027

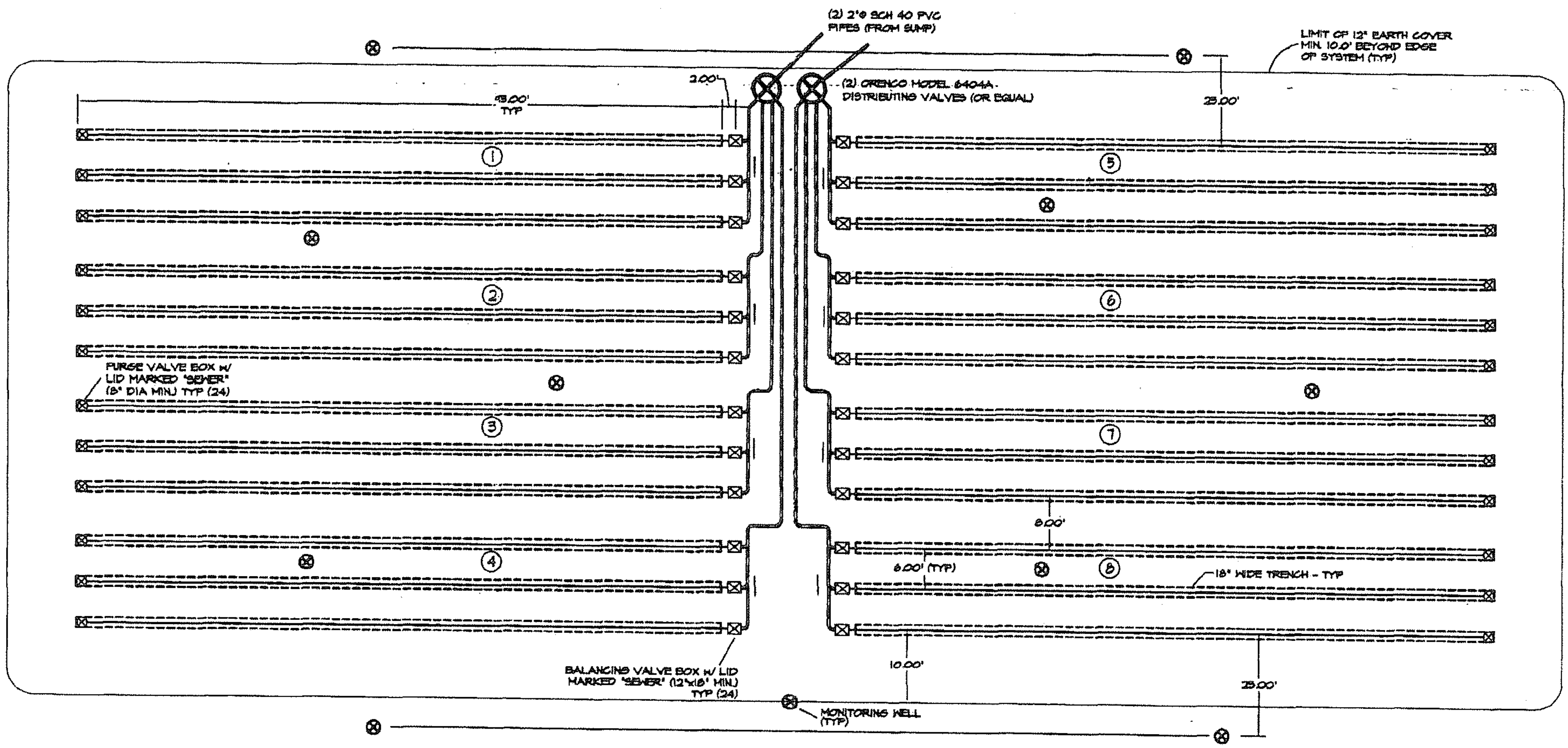
Pond Water Balance

Month	Initial Volume (gal)	Process Waste Inflow (gal)	Pond Evaporation	100-Year Precipitation	Volume Change	Total Volume (gal)	PW Reclaimed For Irrigation	Well Water (to maintain min. volume)	Rainwater Diverted to Vineyard	End Of Month Volume	Capacity Check
January	115,000	16,000	-3,265	41,069	53,804	168,804	-16,000	0		152,804	OK
February	152,804	24,000	-4,588	43,554	62,967	215,771	-24,000	0		191,771	OK
March	191,771	24,000	-8,087	30,239	46,152	237,923	-24,000	0		213,923	OK
April	213,923	18,000	-12,419	11,717	17,298	231,222	-18,000	0		213,222	OK
May	213,222	24,000	-18,991	7,693	12,702	225,924	-24,000	0		201,924	OK
June	201,924	28,000	-23,472	947	5,475	207,399	-28,000	0		179,399	OK
July	179,399	34,000	-28,209	0	5,791	185,190	-34,000	0		151,190	OK
August	151,190	40,000	-25,733	296	14,562	165,753	-40,000	0		125,753	OK
September	125,753	64,000	-18,500	1,657	47,157	172,910	-49,005	0		123,905	OK
October	123,905	56,000	-12,205	10,948	54,742	178,647	-49,005	0		129,642	OK
November	129,642	42,000	-5,292	26,570	63,279	192,921	-49,005	0	-26,570	117,346	OK
December	117,346	30,000	-3,542	42,134	68,592	185,938	-44,985	0	-25,953	115,000	OK
Total		400,000	-164,302	216,825	452,523		-400,000				

madrone
engineering

APPENDIX 2:
SITE EVALUATION REPORT & AS-BUILT DRAWINGS


MONITORING WELL (TYP OF 11)
13.0'
25.0'
DRAINAGE DITCH
(N) SEPTIC FIELDS
(5) LINES @ 95 LF EACH
IN (8) SEPARATE FIELDS
(2) 2"Ø SCH 40 PVC FEED LINES
1,500-GAL SUMP TANK
(2) ORENCO MODEL 6404A DISTRIBUTING VALVES
1,500-GAL SEPTIC TANK
2,000-GAL SEPTIC TANK
DOMESTIC WASTE LINE
WINERY WASTE LINES
"ORENCO SYSTEMS" (OR EQUAL) DUPLEX CONTROL PANEL w/ HAND-OFF-AUTO SWITCH AND AUDIO-VISUAL ALARM NEMA TYPE 4 OR BETTER - MOUNT AT WINERY
PANEL CONTAINS NON-RESETTABLE DOSE COUNTER
1
2
3
4
5
6
7
8
AS BUILT
CALISTOGA CELLARS
APN 017-210-008
14 OCT 2003



AS BUILT
CALISTOGA CELLARS
APN 017-210-008
14 OCT 2003

Napa County Department of Environmental Management

SITE EVALUATION REPORT

Please attach an 8.5" x 11" plot map showing the locations of all test pits triangulated from permanent landmarks or known property corners. The map must be drawn to scale and include a North arrow, surrounding geographic and topographic features, direction and % slope, distance to drainages, water bodies, potential areas for flooding, unstable landforms, existing or proposed roads, structures, utilities, domestic water supplies, wells, ponds, existing wastewater treatment systems and facilities.

Permit #:	EH-540
APN:	017-210-027
(County Use Only) Reviewed by: [signature]	Date: 12/20/11

PLEASE PRINT OR TYPE ALL INFORMATION

Property Owner: ENVY WINES	☐ New Construction ☒ Addition ☐ Remodel ☐ Relocation ☐ Other:
Property Owner Mailing Address: 1170 TUBBS LANE	☐ Residential - # of Bedrooms: Design Flow: gpd
City: CALISTOGA State: CA. Zip: 94515	☒ Commercial – Type: Sanitary Waste: 683 gpd PEAK Process Waste: 1250 gpd TOTAL PEAK
Site Address/Location: 1170 TUBBS LANE CALISTOGA, CA	☐ Other: Sanitary Waste: gpd Process Waste: gpd

Evaluation Conducted By:

Company Name	Evaluator's Name	Signature (Civil Engineer, R.E.H.S., Geologist, Soil Scientist)
ROBERTSON ENGINEERING	MIKE ROBERTSON	[signature]
Mailing Address: 2300 BETHARDS DRIVE, SUITE L		Telephone Number: 707-523-7490
City: SANTA ROSA; State: CA. Zip: 95405		Date Evaluation Conducted: NOVEMBER 9, 2011

Primary Area	**Expansion Area**
Acceptable Soil Depth: 24 in. Test pit #'s: PREVIOUS PD EXPANSION AREA PLUS #2 & 8	Acceptable Soil Depth: 24 in. Test pit #'s: 1-8
Soil Application Rate (gal. /sq. ft. /day): 0.4	Soil Application Rate (gal. /sq. ft. /day): 0.4
System Type(s) Recommended: PRE-TREATMENT, WITH SUBSURFACE DRIP DISPERSAL	System Type(s) Recommended: PRE-TREATMENT, WITH SUBSURFACE DRIP DISPOSAL
Slope: %. Distance to nearest water source: 100 ft. MIN	Slope: <5 %. Distance to nearest water source: 100 ft. MIN
Hydrometer test performed? No ☐ Yes ☒ (attach results)	Hydrometer test performed? No ☐ Yes ☒ (attach results)
Bulk Density test performed? No ☒ Yes ☐ (attach results)	Bulk Density test performed? No ☒ Yes ☐ (attach results)
Groundwater Monitoring Performed? No ☒ Yes ☐ (attach results) DRY	Groundwater Monitoring Performed? No ☒ Yes ☐ (attach results) DRY

Site constraints/Recommendations:

100' MIN DISTANCE FROM ANY WELLS.
100' MIN DISTANCE FROM ANY PONDS,
25' MIN DISTANCE FROM SITE DRAINAGE DITCHES

SCANNED

Test Pit # 1

PLEASE PRINT OR TYPE ALL INFORMATION

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-24"	C	—	BROWN SCL	M, AB	SH	F	SS	C, F	F-C, M	~~F, F~~ NONE
25"-32"	C	—	DARK BROWN CL	M, AB	H	VF	VS	F, F	TO 30" F, F	NONE
33"-60"	C	—	DARK BROWN CLAY	M, AB	H	VF	VS	F, F	NONE	F, Ft
DRY TO BOTTOM OF TRENCH; ROOTS TO 30"										

Test Pit # 2

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-30"	C	—	BROWN SIC	M, AB	SH	F	SS	F, F	C; F	NONE
31-36"	A	—	LS, WITH SOME GRAVEL	M, G	S	L	NS	C, M	NONE	C, M, D
37"-60"	C	—	DARK BROWN CLAY	M, AB	H	VF	VS	F, F.	NONE	F, F, Ft
DRY TO BOTTOM OF TRENCH; ROOTS TO 30"										

Test Pit # 3

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence			Pores	Roots	Mottling
					Side Wall	Ped	Wet			
0-27"	C	—	SIC	M, AB	SH	F	SS	F, F	C, F	NONE
28"-34"	A	—	LS WITH SOME GRAVEL	M, G	S	L	NS	C, M.	NONE	C, M, D
35"-60"	C		DARK BROWN C	M, AB	H	VF	VS	F, F	NONE	F, F Ft
DRY TO BOTTOM OF TRENCH; ROOTS TO 27"										

Attach additional sheets as needed

Test Pit # 4

PLEASE PRINT OR TYPE ALL INFORMATION

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence Side Wall	Consistence Ped	Consistence Wet	Pores	Roots	Mottling
0-30"	C	–	BROWN SCL	M, AB	SH	F	SS	C, F	C, F	NONE
31"-42"	C	–	SIC	M, AB	SH	F	SS	F, F	NONE	F, F
43"-60"	C	–	DARK BROWN C	M, AB	H	VF	VS	F, F	NONE	F, F, F
DRY TO BOTTOM OF TRENCH; ROOTS TO 42"										

Test Pit # 5

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence Side Wall	Consistence Ped	Consistence Wet	Pores	Roots	Mottling
0-28"	C	–	LIGHT BROWN SC	M, AB	SH	F	SS	C, F	C, F	NONE
29-60"	C	–	DARK BROWN SIC	M, AB	H	VF	VS	F, F	F, F ~~NONE~~	F, F
DRY TO BOTTOM OF TRENCH; ROOTS TO 36"										

Test Pit # 6

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence Side Wall	Consistence Ped	Consistence Wet	Pores	Roots	Mottling
0-26"	C	–	LIGHT BROWN SC	M, AB	SH	F	SS	C, F	C, F	NONE
27"-60"	C	–	DARK BROWN SIC	M, AB	H	VF	VS	F, F	F, F ~~NONE~~	F, F
DRY TO BOTTOM OF TRENCH; ROOTS TO 42"										

Attach additional sheets as needed

Test Pit # 7

PLEASE PRINT OR TYPE ALL INFORMATION

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence Side Wall	Consistence Ped	Consistence Wet	Pores	Roots	Mottling
0-20"	C	—	TIGHT BLACK SIC	M, AB	SH	F	SS	F, F	C, F	NONE
20"-60"	C	—	DARK BROWN C	M, AB	H	VF	VS	F, F	F, F	F, Ft
DRY TO BOTTOM OF TRENCH; ROOTS TO 40"										

Test Pit # 8

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence Side Wall	Consistence Ped	Consistence Wet	Pores	Roots	Mottling
0-28"	C	—	BROWN SC	M, AB	SH	F	SS	F, F	C, F	NONE
29"-34"	C	—	LS WITH B-M GRAVEL	M, G	S	L	NS	C M	NONE	C M, D
35"-60"	C	—	DARK BROWN SIC	M, AB	SH	F	SS	F F	C, F.	F, Ft
DRY TO BOTTOM OF TRENCH; ROOTS TO 28"										

Test Pit #

Horizon Depth (Inches)	Boundary	%Rock	Texture	Structure	Consistence Side Wall	Consistence Ped	Consistence Wet	Pores	Roots	Mottling

Attach additional sheets as needed

RGH CONSULTANTS

Experience is the difference

November 15, 2011
File: 9267.1

Robertson Engineering
2300 Bethards Dr., Suite L
Santa Rosa, CA 95405

Subject: **Laboratory Test Results**
Soil Texture Analysis by
Bouyoucos Hydrometry Method
Envy Wines

Dear Mr. Bartelt:

This letter transmits the results of our laboratory testing performed for the subject project. Your personnel delivered the samples on November 10, 2011.

We performed a Soil Texture Analysis by the Bouyoucos Hydrometery Method with the following results:

Size/Density	Hole 1 @ 16"
+ #10 Sieve	10.5 %
Sand	43.4 %
Clay	28.8 %
Silt	27.8 %
Db g/cc	--

We trust this provides the information required at this time. Should you have further questions, please call.

Yours very truly,

RGH GEOTECHNICAL

George Fotou
Laboratory Manager

RGH

Experience is the difference

November 15, 2011
File: 9267.1

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2300 Bethards Dr., Suite L
Santa Rosa, CA 95405

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Soil Texture Analysis by
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Envy Wines

Dear Mr. Bartelt:

This letter transmits the results of our laboratory testing performed for the subject project. Your personnel delivered the samples on November 10, 2011.

We performed a Soil Texture Analysis by the Bouyoucos Hydrometery Method with the following results:

Size/Density	Hole 4 @ 24"
+ #10 Sieve	3.5 %
Sand	27.2 %
Clay	40.8 %
Silt	32.0 %
Db g/cc	--

We trust this provides the information required at this time. Should you have further questions, please call.

Yours very truly,

RGH GEOTECHNICAL

George Fotou
Laboratory Manager

RGH CONSULTANTS

Experience is the difference

November 15, 2011
File: 9267.1

Robertson Engineering
2300 Bethards Dr., Suite L
Santa Rosa, CA 95405

Subject: Laboratory Test Results
Soil Texture Analysis by
Bouyoucos Hydrometry Method
Envy Wines

Dear Mr. Bartelt:

This letter transmits the results of our laboratory testing performed for the subject project. Your personnel delivered the samples on November 10, 2011.

We performed a Soil Texture Analysis by the Bouyoucos Hydrometery Method with the following results:

Size/Density	Hole 5 @ 24"
+ #10 Sieve	2.9 %
Sand	39.4 %
Clay	34.8 %
Silt	25.8 %
Db g/cc	--

We trust this provides the information required at this time. Should you have further questions, please call.

Yours very truly,

RGH GEOTECHNICAL

George Fotou
Laboratory Manager

RGH CONSULTANTS

Experience is the difference

November 28, 2011
File: 9267.1

Robertson Engineering
2300 Bethards Dr., Suite L
Santa Rosa, CA 95405

Subject: **Laboratory Test Results**
Soil Texture Analysis by
Bouyoucos Hydrometry Method
Envy Wines

Dear Mr. Bartelt:

This letter transmits the results of our laboratory testing performed for the subject project. Your personnel delivered the samples on November 10, 2011.

We performed a Soil Texture Analysis by the Bouyoucos Hydrometery Method with the following results:

Size/Density	Hole 8 @ 24"
+ #10 Sieve	5.1 %
Sand	30.4 %
Clay	42.8 %
Silt	26.8 %
Db g/cc	--

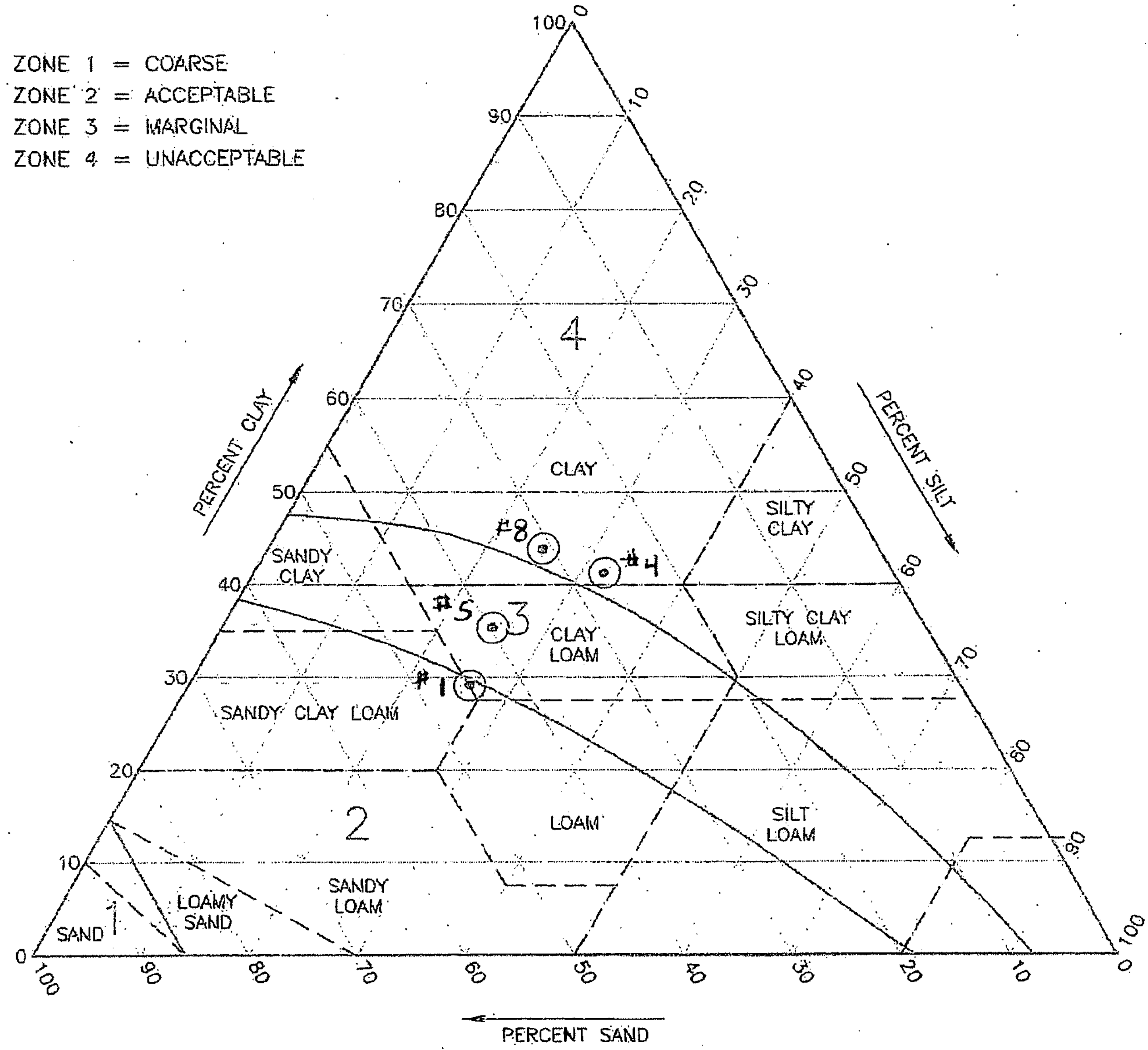
We trust this provides the information required at this time. Should you have further questions, please call.

Yours very truly,

RGH GEOTECHNICAL

George Fotou
Laboratory Manager

SOIL PERCOLATION SUITABILITY CHART

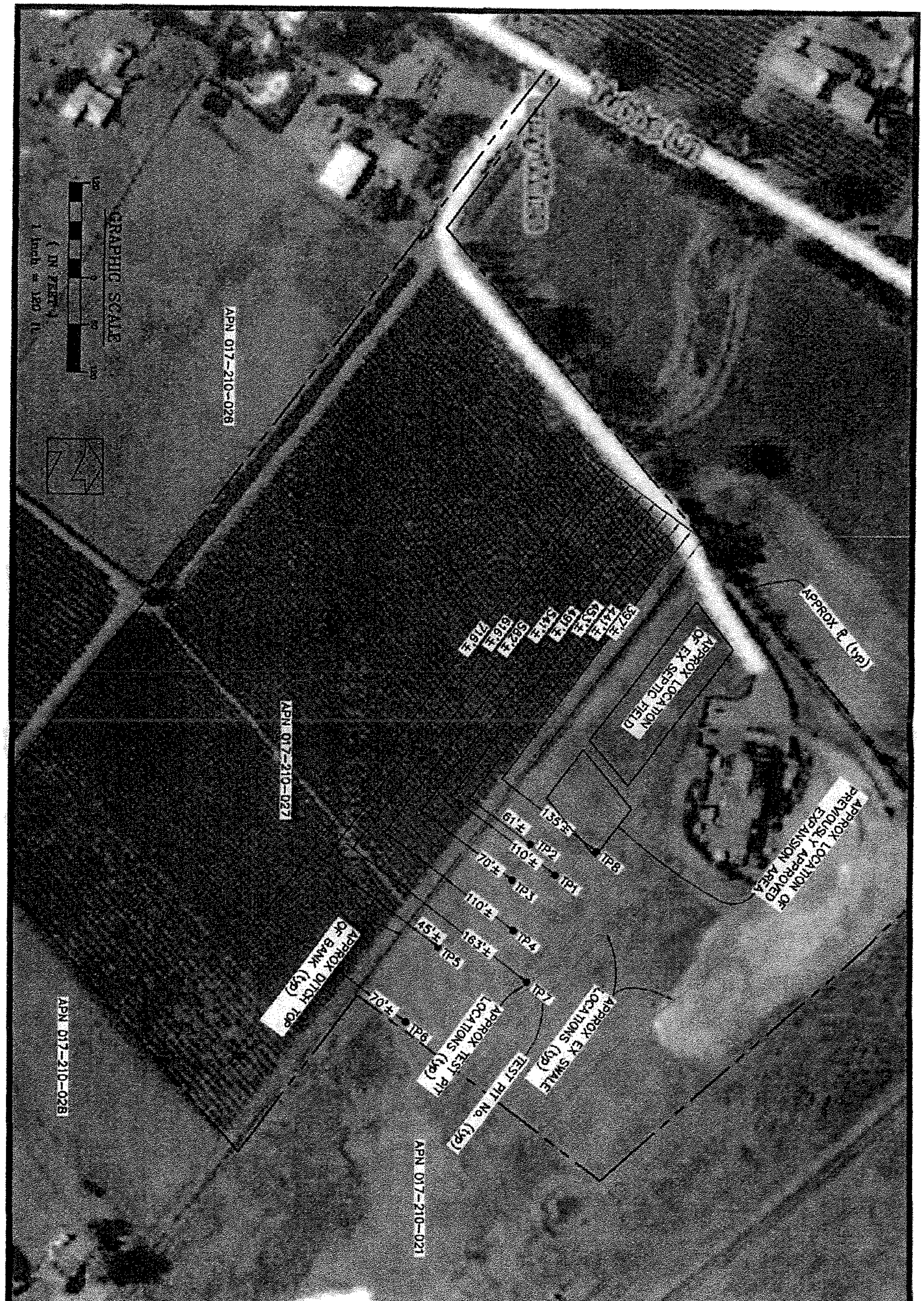


Instructions:

1. Plot texture on triangle based on percent sand, silt, and clay as determined by hydrometer analysis.
2. Adjust for coarse fragments by moving the plotted point in the sand direction an additional 2% for each 10% (by volume) of fragments greater than 2mm in diameter.
3. Adjust for compactness of soil by moving the plotted point in the clay direction an additional 15% for soils having a bulk-density greater than 1.7 gm/cc.

Note:

For soils falling in sand, loamy sand or sandy loam classification bulk density analysis will generally not affect suitability and analysis not neccesary.

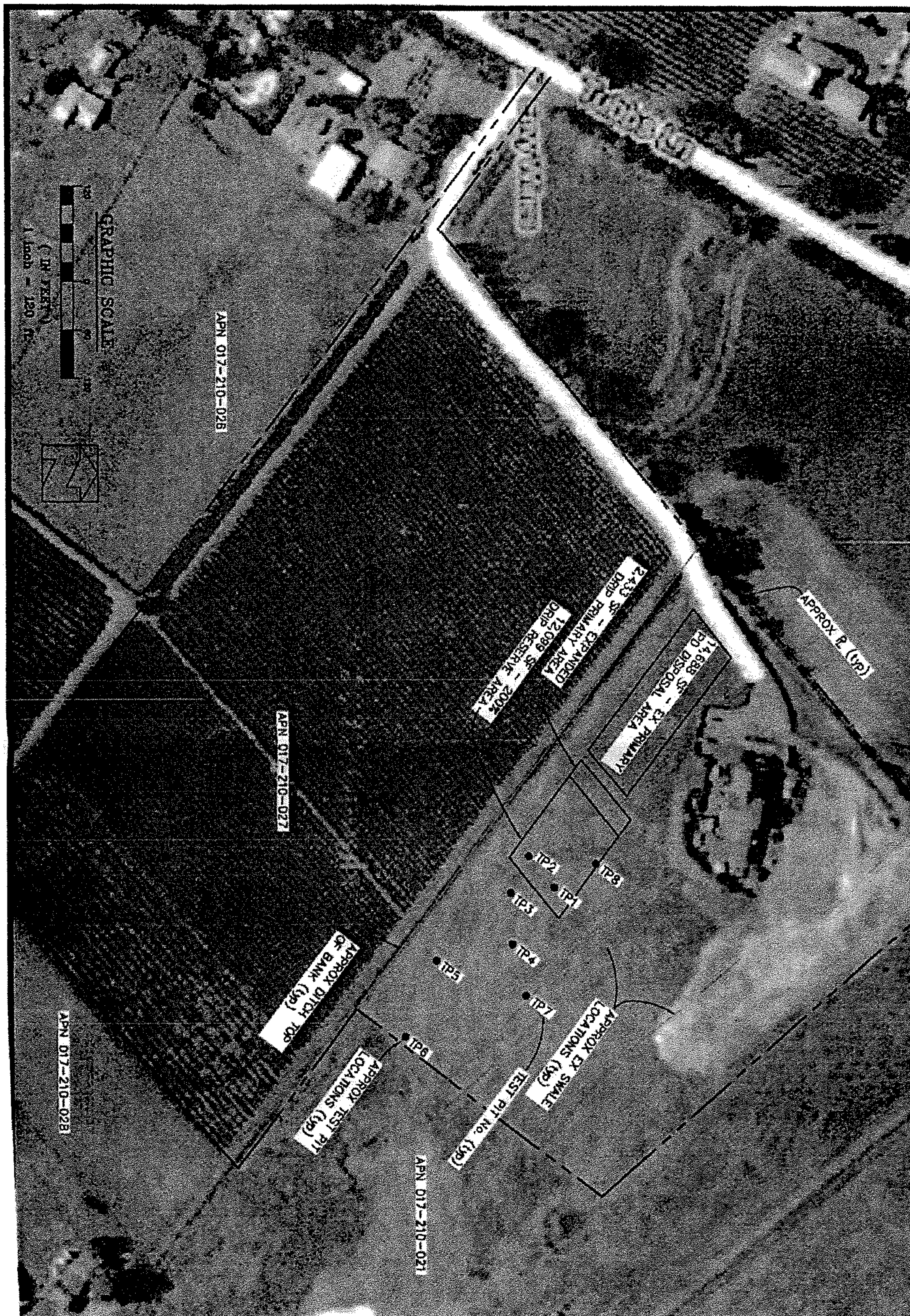


TEST PIT LOCATIONS

1170 TUBBS LANE
CALISTOGA, CA
APN 017-210-027

ROBERTSON ENGINEERING Inc
2300 BETHARDS DRIVE, SUITE L,
SANTA ROSA, CA 95405
Tel 707.523.7490
Fax 707.523.7499
E-mail
office@robertsonengineering.net

JOB #11027	DATE: December 2011	SCALE: 1"=120'	EXHIBIT 1



SUBSURFACE DRIP SYSTEM
1170 TUBBS LANE
CALISTOGA, CA
APN 017-210-027

ROBERTSON ENGINEERING Inc
2300 BETHARDS DRIVE, SUITE L
SANTA ROSA, CA 95405
Tel 707.523.7490
Fax 707.523.7499
E-mail
office@robertsonengineering.net

JOB #11027	DATE: December 2011	SCALE: 1"=120'	EXHIBIT 2