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Wastewater Feasibility Study

WASTEWATER FEASIBILITY STUDY

CAYMUS VINEYARDS

Rurtherford, California
APN 030-200-066

SUMMIT
CIVIL STRUCTURAL ELECTRICAL WATER|WASTEWATER

Project No. 2013044
September 25, 2015

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LIST OF ENCLOSURES

PROJECT OVERVIEW

Caymus Vineyards is applying for a Use Permit Modification for the existing winery facility located in Rutherford, Napa County, California with a Phase I production capacity of 110,000 gallons and a Phase II maximum capacity of 660,000 gallons. The existing Lyve System (process wastewater) and existing leachfield (sanitary sewage) will be used for Phase I. A combined process wastewater (PW) and sanitary sewage (SS) system (improved Lyve System) will be used for Phase II. An overview of this management system is discussed in this report.

SITE DESCRIPTION

The property is located at the intersection of Rutherford and Conn Creek Roads, east of the town of Rutherford with Conn Creek running along the eastern edge of the winery facility and through the middle of the parcel. The parcel is relatively flat except for the banks of Conn Creek.

The existing winery facility includes an assortment of buildings (some of which will be demolished and rebuilt). An existing irrigation pond and vineyards are located to the east of Conn Creek.

WASTEWATER MANAGEMENT SYSTEM

PW and SS will initially continue to be plumbed and treated separately in their respective, existing systems. For Phase II, PW and SS will initially continue to be plumbed separately and will then be combined at the existing Lyve System which will remain in Building B3. Effluent will be sent from Lyve System, through a 2" forcemain (utilizing an existing 2" pipeline that crosses Conn Creek) out to the existing irrigation pond, which is proposed to be converted to an effluent storage pond. From the effluent storage pond, effluent will be utilized for onsite surface irrigation disposal.

This section of the wastewater feasibility study details the PW and SS characteristics and proposed wastewater management system.

PROCESS WASTEWATER CHARACTERISTICS

PW will consist primarily of wastewater collected at floor drains and trenches within the winery, receiving, crush, tank, and washdown areas. Any exterior tank and process areas not under a roof will be provided with automated diversion capability to provide a means of routing rainwater to the storm drainage system when those areas are not in use for process purposes. No distillation will occur at the facility; hence there will be no stillage waste. Typical winery wastewater characteristics are as summarized below:

Characteristic	Units	Crushing Season Range	Non-crushing Season Range
pH	--	2.5 - 9.5	3.5 - 11.0
Dissolved Oxygen	mg/L	0.5 - 8.5	1.0 - 10.0
BOD_5	mg/L	500 – 12,000	300 – 3,500
COD	mg/L	800 – 15,000	500 – 6,000
Grease	mg/L	5 - 30	5 - 50
Settleable Solids	mg/L	25 - 100	2 - 100
Nonfilterable Residue	mg/L	40 - 800	10 - 400
Volatile Suspended Solids	mg/L	150 - 700	80 - 350
Total Dissolved Solids	mg/L	80 – 2,900	80 – 2,900
Nitrogen	mg/L	1 - 40	1 - 40
Nitrate	mg/L	0.5 - 4.8	-
Phosphorous	mg/L	1 - 10	1 - 40
Sodium	mg/L	35 - 200	35 - 200
Alkalinity ($CaCO_3$)	mg/L	40 - 730	10 - 730
Chloride	mg/L	3 - 250	3 - 250
Sulfate	mg/L	10 - 75	20 - 75

SANITARY SEWAGE CHARACTERISTICS

Sanitary sewage (SS) will consist primarily of wastewater generated from restrooms, laboratory, employee kitchen, and tasting room facilities. Typical sanitary sewage characteristics are as summarized below:

Characteristic	Units	Raw Wastewater[1] Range
BOD_5	mg/L	110 - 220
Grease	mg/L	50-100
Total Suspended Solids (TSS)	mg/L	100 - 220
Volatile Suspended Solids	mg/L	80 - 165
Total Dissolved Solids (TDS)	mg/L	250 - 500
Nitrogen	mg/L	20 - 40
Nitrate	mg/L	0
Phosphorous	mg/L	4 - 8
Alkalinity ($CaCO_3$)	mg/L	50 - 100
Chloride	mg/L	30 - 50
Sulfate	mg/L	20 - 30

[1]Typical composition of untreated domestic wastewater, Metcalf & Eddy, "Wastewater Engineering, Third Edition", 1991

PROCESS WASTEWATER DESIGN FLOWS (PHASE I)

Based on typical flow data from wineries of similar size and characteristics and corresponding PW generation rates, projected flows are calculated as follows:

Annual Volume

Annual production (projected)	=	110,000 gal wine/year
PW generation rate (assumed)	=	4 gal PW/gal wine
PW flow	=	110,000 gal wine x 4 gal PW/gal wine
	=	440,000 gal PW/year

Average Day Flow

440,000 gal PW/365 days = 1,210 gal PW/day

Average Day, Peak Month Flow

The harvest month of September accounts for approximately 16.4 percent of the annual PW flow.

$$440{,}000 \text{ gal PW} \times \frac{(0.164)}{30 \text{ day}} = 2{,}400 \text{ gal PW/day}$$

Napa County Peak Day

$$\frac{110{,}000 \text{ gallons wine} \times 1.5}{60 \text{ day harvest}} = 2{,}750 \text{ gal PW/day}$$

The peak PW flow rate for Phase I is expected to be 2,750 gal/day.

All PW generated from Phase I will continue to be treated in the existing Lyve System. As approved in the existing Very Minor Modification (#P08-00519-VMM), hold and haul will be utilized for the disposal of treated PW from the Lyve System.

SANITARY SEWAGE (PHASE I)

Sanitary sewage generated from the existing approved activities will continue to be disposed of in the existing leachfield system. No change in SS flows are proposed. Therefore, no changes are proposed to the existing system.

PROCESS WASTEWATER DESIGN FLOWS (PHASE II)

Annual Volume

Annual production (projected)	=	660,000 gal wine/year
PW generation rate (assumed)	=	4 gal PW/gal wine
PW flow	=	660,000 gal wine x 4 gal PW/gal wine
	=	2,640,000 gal PW/year

Average Day Flow

2,640,000 gal PW/365 days = 7,240 gal PW/day

Average Day, Peak Month Flow

The harvest month of September accounts for approximately 16.4 percent of the annual PW flow.

$$2{,}640{,}000 \text{ gal PW} \times \frac{(0.164)}{30 \text{ day}} = 14{,}400 \text{ gal PW/day}$$

Napa County Peak Day

$$\frac{660{,}000 \text{ gallons wine} \times 1.5}{60 \text{ day harvest}} = 16{,}500 \text{ gal PW/day}$$

The peak PW flow rate for Phase II is expected to be 16,500 gal/day.

SANITARY SEWAGE DESIGN FLOWS (PHASE II)

The proposed winery SS flows for Phase II at Caymus will consist of typical wastewater generated from restrooms, laboratory, and employee kitchen facilities. The anticipated peak winery SS flow is summarized below:

Peak Tasting Day w/o Event							
Employee (full-time)	42	x	15	gpcd	=	630	gal/day
Employee (part-time)	14	x	15	gpcd	=	210	gal/day
Tasting Visitors	450	x	3	gpcd	=	1,350	gal/day
Total					=	**2,190**	**gal/day**

Peak Tasting Day w/ Event							
Employee (full-time)	42	x	15	gpcd	=	630	gal/day
Employee (part-time)	14	x	15	gpcd	=	210	gal/day
Tasting Visitors	450	x	3	gpcd	=	1,350	gal/day
Event Visitors	100	x	15	gpcd	=	1,500	gal/day
Total					=	**3,690**	**gal/day**

The peak SS flow rate associated with Phase II is expected to be 3,690 gal/day.

TOTAL WASTEWATER DESIGN FLOWS (PHASE II)

The peak flow rate from the two waste streams for Phase II is expected to be 20,190gpd (16,500 gpd of PW and 3,690 gpd of SS).

WASTEWATER CONVEYANCE, TREATMENT AND DISPOSAL (PHASE II)

The winery treatment and disposal system for Phase II will consist of the components described below. Refer to the wastewater management system schematic in Enclosure A for a flow diagram of the wastewater management system.

1) Initial screening – Provided by screened baskets and strainers installed on the trench drains and floor drains within the winery. Screen opening sizes will be approximately 1/4 inch for exterior drains and 1/8 inch for interior drains.

2) Gravity collection system – New gravity collection piping to serve the winery PW and SS should be designed to provide low maintenance and no infiltration or exfiltration. Piping must satisfy Uniform Plumbing Code and local requirements.

3) Septic Tanks – There is a series of existing septic tanks that will be continued to be used. These tanks will overflow SS to the existing Lyve system (a pump sump may be required).

4) Pump Sump – PW that will following the automated stormwater diversion valve, may need to be collected in a sump and pumped to the existing Lyve system.

5) Screening/Settling Tank – It is proposed to utilize the existing solids screen prior to sending PW to the equalization zone/Lyve system.

6) Lyve System – Treatment of combined wastewater will be accomplished in the existing Lyve treatment system which is a packaged treatment systems specifically oriented towards winery wastewater. Lyve utilizes aerobic activated sludge treatment in a modular design. These systems are capable of producing high quality effluent while taking up a small footprint. A custom, above grade concrete treatment tank will be utilized for the Lyve system. Internal zones are proposed to be located inside the treatment tank to compartmentalize the treatment system.

    a. Equalization Zone/tank – Wastewater will first be combined in an equalization zone/tank provided to allow for equalization (EQ) of peak flows prior to treatment in the Lyve system. Aeration will be provided in the equalization zone to allow for adequate mixing of the wastewater to occur.

    b. pH adjustment – A HACH pH analyzer/controller and a chemical dosing pump will be provided by Lyve for automatic adjusting for influent pH to remain between 6.8 and 7.2 pH units. Magnesium hydroxide will be used for pH adjustment in the wastewater stream.

    c. MBBR Zone – A zone will be provided in the treatment tank for biological treatment. The MBBR zone will contain plastic media which provides surface area for biomass to develop. Aeration is provided in this zone to promote biological growth and degradation of wastewater flows.

    d. Activated Sludge Zone – An activated sludge zone is provided in the treatment tank downstream of the MBBR zone to further treat process wastewater flows through activated sludge treatment. A coarse bubble diffuser is provided to allow for mixing and further degradation of wastewater flows.

e. Clarifier - Following the activated sludge zone, the wastewater will pass into a clarifier where clean effluent decants off the top and solids settle to the bottom. Clarified effluent will flow into a pump sump where it will be pumped out to the effluent storage pond. Solids that settle to the bottom of the clarifier will be pumped back to the selector zone. A measured amount of sludge is wasted to sludge digesters.

f. Sludge Digester Zone – A sludge digester zone will be provided in the main treatment tank for storage and digestion of wasted activated sludge from the clarifier. Periodic off-hauling or onsite pressing of the accumulated solids in the digester will be required unless an onsite sludge dewatering system is installed.

A control panel is and will continue to be provided for control of the blowers, pH monitoring and correction system, foam control, any influent pumps, effluent pump and other ancillary items. This system will include web based monitoring capabilities.

7) Effluent Pumps –Duplex pumps will be capable of pumping treated effluent, with lead/lag and alternating pump capabilities, from the existing Lyve System out to the effluent pond.

8) Flow measurement – An inline flow measurement device will be provided to measure flows from the Lyve System to the effluent storage pond.

9) Effluent storage pond – Effluent from the Lyve treatment system for Phase II will flow to an approximate 1.7 MGallon effluent storage pond (an existing irrigation pond that will be converted to an effluent storage pond).

10) Flow measurement – An inline magnetic flow measurement device will be provided following the irrigation pump. This will allow for measurement of flows from the effluent storage pond to the surface disposal system.

11) Filtration/Disinfection - Prior to surface disposal, effluent will go through a media filter and disinfected (via UV or Peroxyacetic acid) to meet Title 22, recycled water standards.

12) Effluent Surface Disposal –Final reuse (disposal) of effluent shall be accomplished by drip irrigation of a minimum of 10.0 acres (Phase II) of vineyard. The irrigation demand of the vineyard far exceeds the estimated annual wastewater volume (see Pond Water Balance in Enclosure C). To meet the additional irrigation demand the treated wastewater will be supplemented with irrigation water.

OTHER CONSIDERATIONS

ODOR CONTROL

There should be no noxious odors from a properly designed and operated treatment system. See Alternative Courses of Action for operation alternatives.

GROUND WATER CONTAMINATION

The nearest water well to the wastewater treatment and disposal system will be a minimum of 100 feet. No disposal of reclaimed wastewater will occur within 100 feet of any existing wells.

Irrigation/disposal of treated effluent is considered a beneficial use and is considered an effective means to protect groundwater quality.

PROTECTION

Exposed wastewater treatment facilities should be posted with appropriate warning signs. The treatment areas will be protected to restrict access and potential damage to the system.

ALTERNATIVE COURSES OF ACTION

Although no operational difficulties are foreseen, the following additional courses of action would be available if necessary for the PW system:

- Additional stages of treatment to increase effluent quality
- Increased use of irrigation/disposal area to increase discharge capacity
- Aeration in the effluent storage pond to improve effluent quality

The effluent storage pond will be sized for retention of wastewater effluent through the majority of the rainy season with minimal discharges to irrigation areas (if surface applied). Should there be a winter with more rainfall than the design condition; several operational procedures are available to compensate:

- Additional water conservation at winery
- Light irrigation during periods between storms – not exceeding the assimilative capacity of the soil
- Increased irrigation during the months of planned irrigation
- Pumping and truck transfer of treated and diluted wastewater to an approved treatment plant or land disposal site

SOLID WASTES

Solid wastes from the winery include primarily pomace, seeds, and stems. The estimated quantities of these wastes (at ultimate capacity) are as follows:

$$\text{Phase II Annual Total} = \frac{1 \text{ ton grapes}}{165 \text{ gal wine}} \times 660{,}000 \text{ gal wine } \times 35\% = 1{,}400 \text{ tons}$$

Based on a unit weight of 38 pounds per cubic foot, the annual volume of solids wastes would be:

$$1{,}400 \text{ tons } \times \frac{2000 \text{ lb}}{1 \text{ ton}} = 2{,}800{,}000\text{lb}$$
$$2{,}800{,}000 \text{ lbs } \times \frac{1 \text{ ft}^3}{38 \text{ lb}} \times \frac{1 \text{ yd}^3}{27 \text{ ft}^3} = 2729 \text{ yd}^3$$

These organic solids will be composted, spread on the vineyard, and disked in as a soil conditioner and supplemental nutrient source on a routine basis. This quantity of solids wastes is to be applied to the approximate onsite vineyard or will be hauled to an off-site composting location to reduce the application depth, if needed.

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CAYMUS VINEYARDS

ENCLOSURE A

OVERALL SITE PLAN (UP1)
WASTEWATER TREATMENT PLAN (UP4)
CONCEPT WASTEWATER UTILITY PLAN (UP5)
EXISTING WASTEWATER TREATMENT (UP8)

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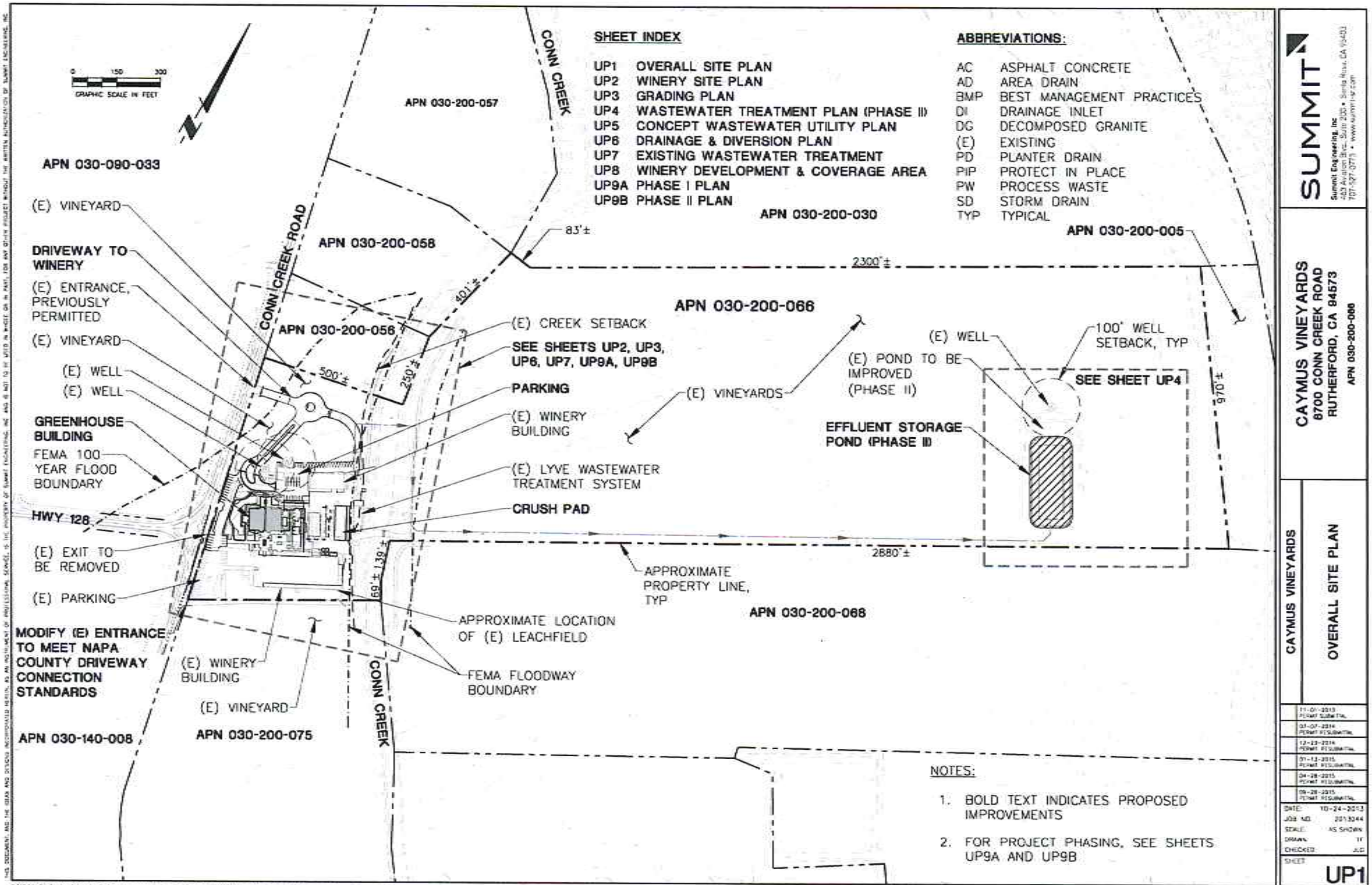
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SHEET INDEX
UP1 OVERALL SITE PLAN
UP2 WINERY SITE PLAN
UP3 GRADING PLAN
UP4 WASTEWATER TREATMENT PLAN (PHASE II)
UP5 CONCEPT WASTEWATER UTILITY PLAN
UP6 DRAINAGE & DIVERSION PLAN
UP7 EXISTING WASTEWATER TREATMENT
UP8 WINERY DEVELOPMENT & COVERAGE AREA
UP9A PHASE I PLAN
UP9B PHASE II PLAN
ABBREVIATIONS:
AC ASPHALT CONCRETE
AD AREA DRAIN
BMP BEST MANAGEMENT PRACTICES
DI DRAINAGE INLET
DG DECOMPOSED GRANITE
(E) EXISTING
PD PLANTER DRAIN
PIP PROTECT IN PLACE
PW PROCESS WASTE
SD STORM DRAIN
TYP TYPICAL
APN 030-090-033
APN 030-200-057
APN 030-200-058
APN 030-200-056
APN 030-200-030
APN 030-200-005
APN 030-200-066
APN 030-200-068
APN 030-200-075
APN 030-140-008
CONN CREEK
CONN CREEK ROAD
HWY 128
83'±
2300'±
401'±
500'±
250'±
970'±
2880'±
69'± 139'±
(E) VINEYARD
DRIVEWAY TO WINERY
(E) ENTRANCE, PREVIOUSLY PERMITTED
(E) VINEYARD
(E) WELL
(E) WELL
GREENHOUSE BUILDING
FEMA 100 YEAR FLOOD BOUNDARY
(E) EXIT TO BE REMOVED
(E) PARKING
MODIFY (E) ENTRANCE TO MEET NAPA COUNTY DRIVEWAY CONNECTION STANDARDS
(E) WINERY BUILDING
(E) VINEYARD
(E) CREEK SETBACK
SEE SHEETS UP2, UP3, UP6, UP7, UP9A, UP9B
PARKING
(E) WINERY BUILDING
(E) LYVE WASTEWATER TREATMENT SYSTEM
CRUSH PAD
(E) VINEYARDS
APPROXIMATE PROPERTY LINE, TYP
APPROXIMATE LOCATION OF (E) LEACHFIELD
FEMA FLOODWAY BOUNDARY
(E) WELL
(E) POND TO BE IMPROVED (PHASE II)
EFFLUENT STORAGE POND (PHASE II)
100' WELL SETBACK, TYP
SEE SHEET UP4
NOTES:
1. BOLD TEXT INDICATES PROPOSED IMPROVEMENTS
2. FOR PROJECT PHASING, SEE SHEETS UP9A AND UP9B
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8700 CONN CREEK ROAD
RUTHERFORD, CA 94573
APN 030-200-066
CAYMUS VINEYARDS
OVERALL SITE PLAN
11-01-2013 PERMIT SUBMITTAL
07-07-2014 PERMIT RESUBMITTAL
12-23-2014 PERMIT RESUBMITTAL
01-13-2015 PERMIT RESUBMITTAL
04-28-2015 PERMIT RESUBMITTAL
09-28-2015 PERMIT RESUBMITTAL
DATE: 10-24-2013
JOB NO. 2013044
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UP1
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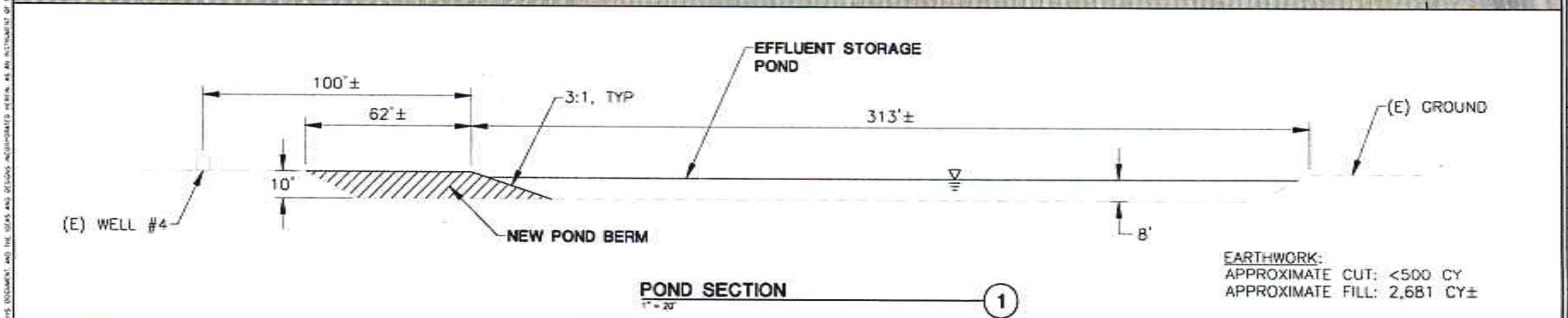

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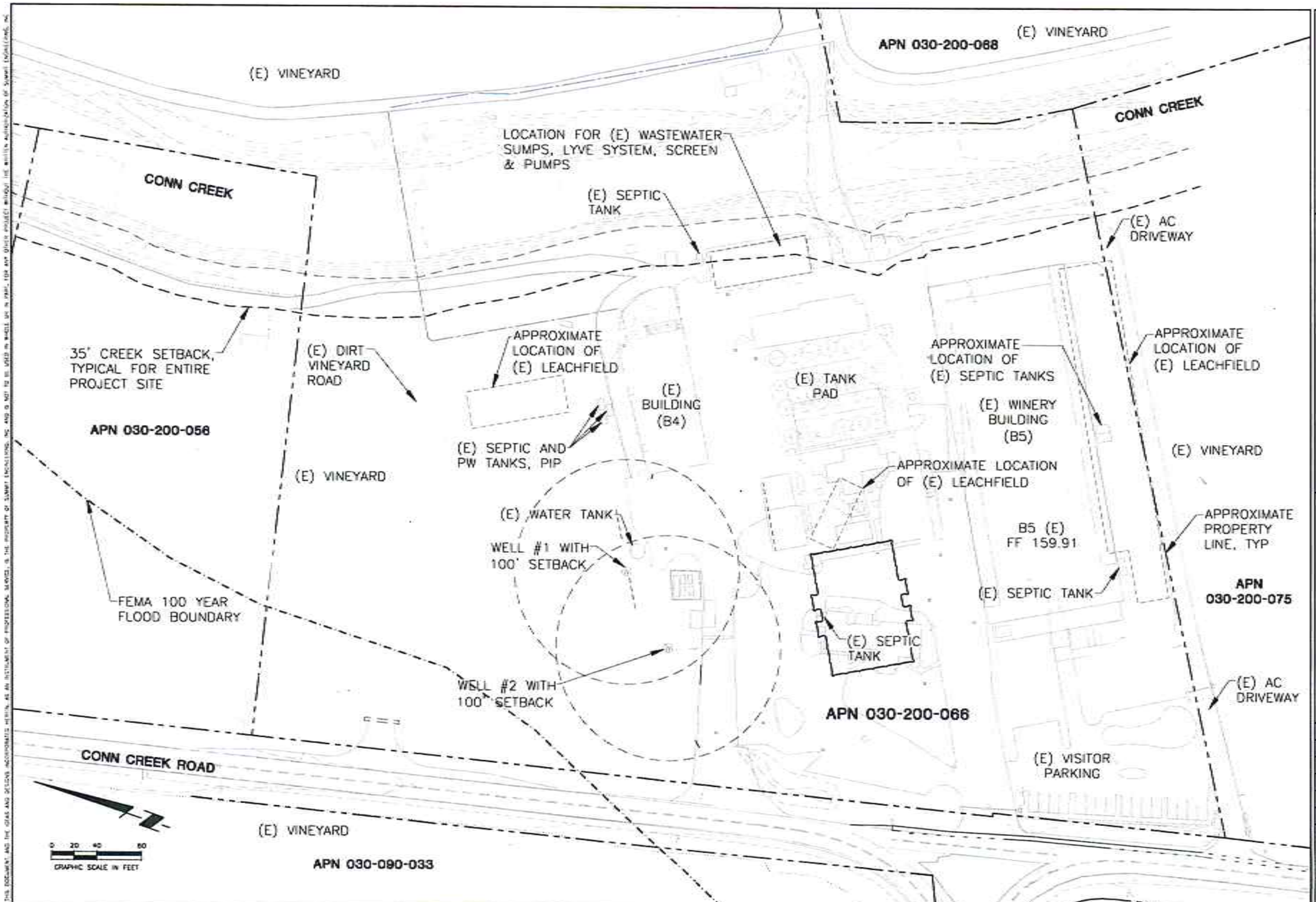
APN 030-200-066

CAYMUS VINEYARDS
WASTEWATER TREATMENT PLAN (PHASE II)

DATE 10-24-2013
JOB NO. 2013044
SCALE AS SHOWN
SHEET UP4

PLOTTED ON: 9/25/2015 1:35 PM



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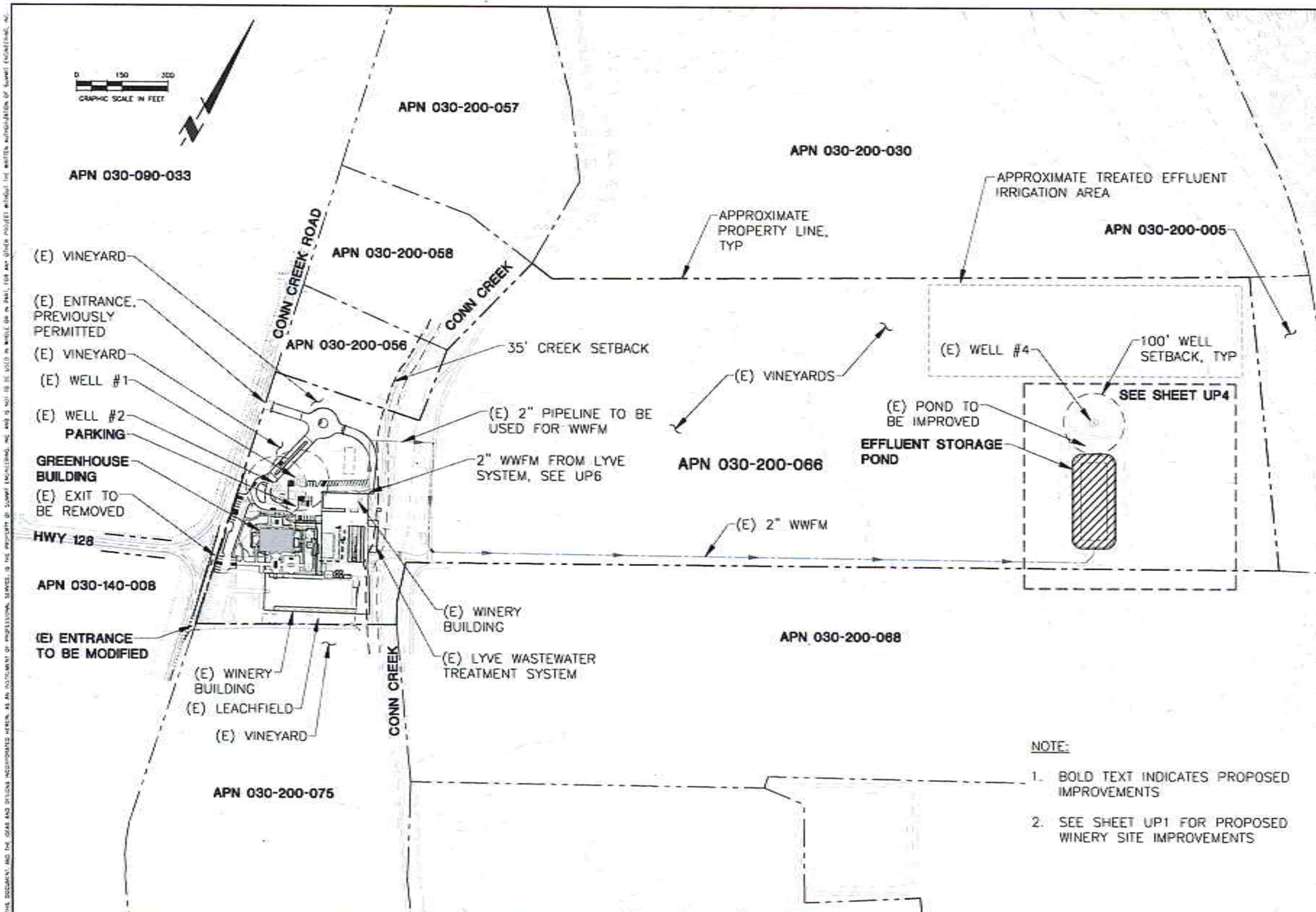
RUTHERFORD, CA 94573
APN 030-200-066

CAYMUS VINEYARDS

EXISTING WASTEWATER TREATMENT

DATE: 10-24-2013
JOB NO: 2013044
SCALE: AS SHOWN
SHEET: **UP7**



NOTE:

1. BOLD TEXT INDICATES PROPOSED IMPROVEMENTS
2. SEE SHEET UP1 FOR PROPOSED WINERY SITE IMPROVEMENTS

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CAYMUS VINEYARDS

CONCEPT WASTEWATER
UTILITY PLAN

11-21-2013	PERMIT SUBMITTAL
01-07-2014	PERMIT RESUBMITTAL
12-23-2014	PERMIT RESUBMITTAL
01-13-2015	PERMIT RESUBMITTAL
04-28-2015	PERMIT RESUBMITTAL
06-26-2015	PERMIT RESUBMITTAL
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JOB NO	2013044
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SHEET	UP5

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CAYMUS VINEYARDS

ENCLOSURE B

PW POND EFFLUENT DISPERSAL WATER BALANCE (PHASE II)

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SUMMIT ENGINEERING, INC. Consulting Civil Engineers	CAYMUS - RUTHERFORD Pond Water Balance - PHASE II	PROJECT NO. BY: CHK:	2013044 GG

DESIGN CRITERIA

FULL PRODUCTION

Annual Production	660,000	gal wine/year
PW Generation Rate	4.0	gal PW/gal wine
Annual PW Flow	2,640,000	gal PW/year
Months of Harvest	Aug-Oct	
Average Day PW Flow	7,240	gal PW/day
Average Day Harvest PW Flow	11,500	gal PW/day
Average Day Peak Harvest Month PW Flow	14,400	gal PW/day
Average Day SS Flows	2,190	gal SS/day
Peak SS Flows	3,690	gal SS/day
Lyve System Inflow/Outflow	7,000	gal PW/day
Effluent Storage Pond	1.706	Mgal
Effluent Storage Pond HRT	112.3	days (based on harvest flows)
Total HRT	112.3	days

DESIGN PROCESS WASTEWATER FLOWS

Month	Monthly Percentage of Annual Flow[a] (%)	Monthly PW Flow (Mgal)	Approx Monthly SS Flow (Mgal)	Monthly PW & SS Flow (Mgal)	Average Daily Flow (gal/day)
August	10.5%	0.276	0.071	0.347	11,188
September	16.4%	0.433	0.069	0.502	16,722
October	12.9%	0.340	0.071	0.411	13,262
November	7.4%	0.196	0.069	0.264	8,812
December	6.4%	0.169	0.071	0.240	7,750
January	6.6%	0.173	0.071	0.244	7,877
February	7.2%	0.191	0.064	0.255	9,107
March	7.6%	0.201	0.071	0.272	8,784
April	6.8%	0.179	0.069	0.248	8,251
May	6.4%	0.170	0.071	0.241	7,779
June	5.6%	0.148	0.069	0.216	7,213
July	6.2%	0.164	0.071	0.234	7,563
Total	**100%**	**2.640**	**0.835**	**3.475**	

[a] Monthly percentage of annual flow based on average of PW flow data from 11 wineries.

SUMMIT ENGINEERING, INC. Consulting Civil Engineers	CAYMUS - RUTHERFORD Pond Water Balance - PHASE II Climate Data	PROJECT NO. BY: CHK:	2013044 GG 0

Month	Days	Average Temp[a] (F)	Reference Evapotranspiration[b] (in)	Pan Evaporation[c] (in)	Lake Evaporation[d] (in)	Average Precipitation[e] (in)	10-Year Precipitation[f] (in)	100-Year Precipitation[f] (in)
August	31	70.7	6.4	12.1	9.3	0.1	0.2	0.2
September	30	67.6	4.9	8.7	6.7	0.4	0.6	0.9
October	31	61.7	3.5	5.7	4.4	2.1	3.2	4.9
November	30	52.3	1.6	2.5	1.9	5.5	8.5	12.7
December	31	46.6	1.2	1.7	1.3	5.9	9.1	13.7
January	31	46	1.0	1.6	1.2	7.9	12.1	18.3
February	28	50.2	1.5	2.2	1.7	5.9	9.1	13.7
March	31	52.3	2.9	3.8	2.9	4.7	7.2	10.9
April	30	56.3	4.7	5.9	4.5	1.9	2.9	4.4
May	31	62.4	5.8	9.0	6.9	0.4	0.6	0.9
June	30	68	6.9	11.0	8.5	0.1	0.2	0.2
July	31	71.1	7.2	13.5	10.4	0.0	0.0	0.0
Total	**365**		**47.7**	**77.7**	**59.8**	**34.9**	**53.6**	**80.9**

[a] Average monthly temperature at St. Helena, 1961-1990. See http://www.worldclimate.com

[b] Average monthly reference evaporation rates for Oakville (#77), 1989-2004 CIMIS, See http://www.cimis.water.ca.gov/cimis/data.jsp

[c] Average monthly pan evaporation rates observed at Santa Rosa, Sonoma County, CA 1958-1970. Source James Goodridge.

[d] Pan evaporation rates adjusted by a factor of 0.77 to determine lake evaporation.

[e] Average monthly rainfall observed at St. Helena, 1961-1990, See http://www.worldclimate.com

[f] Average monthly rainfall adjusted by the ratio of 10-yr and 100-yr wet year return storm identified by Pearsons Log III Distribution (St. Helena)

SUMMIT ENGINEERING, INC. onsulting Civil EngineerWater Balance - PH	CAYMUS - RUTHERFORD Pond Water Balance - PHASE II Pond Worksheet	PROJECT NO. BY: CHK:	2013044 GG 0

Effluent Storage Pond

Bottom Width	85.0'	Bottom Radius	15.0'	Start Month	August
Bottom Length	240.0'	Top Radius	35.0'	Min. Depth	3.0'
Interior Side Slope (x:1)	3.0	Depth	10.0'	Divert Volume	3.69 Mgal
Length:Width	0.4	Freeboard	2.0'	Initial Depth	4.0'

Depth (ft)	Length (ft)	Width (ft)	Radius (ft)	Surface Area (ft^2)	Total Volume (Mgal)
0	240	85	15	20,208	0.000
1	246	91	17	22,139	0.158
2	252	97	19	24,136	0.331
3	258	103	21	26,197	0.520
4	264	109	23	28,324	0.724
5	270	115	25	30,516	0.944
6	276	121	27	32,773	1.180
7	282	127	29	35,096	1.434
8	288	133	31	37,483	1.706
9	294	139	33	39,936	1.995
10	300	145	35	42,454	2.303

Lyve System

Month	Tank Evaporation (Mgal)	Actual PW Inflow (Mgal)	10 Year Precipitation (Mgal)	Volume Change (Mgal)	Divert Volume (Mgal)	Surface Area (ft^2)
August	-0.0012	0.347	0.000020	0.346	0.346	208
September	-0.0009	0.502	0.000080	0.501	0.501	208
October	-0.0006	0.411	0.000419	0.411	0.411	208
November	-0.0003	0.264	0.001096	0.265	0.265	208
December	-0.0002	0.240	0.001176	0.241	0.241	208
January	-0.0002	0.244	0.001574	0.246	0.246	208
February	-0.0002	0.255	0.001176	0.256	0.256	208
March	-0.0004	0.272	0.000937	0.273	0.273	208
April	-0.0006	0.248	0.000379	0.247	0.247	208
May	-0.0009	0.241	0.000080	0.240	0.240	208
June	-0.0011	0.216	0.000020	0.215	0.215	208
July	-0.0013	0.234	0.000000	0.233	0.233	208
Total	**-0.008**	**3.475**	**0.00696**	**3.474**	**3.474**	

*neglect precipitation and assume up to 7,000 gpd in & out

Pond No.

Month	Initial Volume (Mgal)	Pond Evaporation (Mgal)	PW Inflow (Mgal)	10 Year Precipitation (Mgal)	Volume Change (Mgal)	Total Volume (Mgal)	Divert Volume (Mgal)	Final Volume (Mgal)	Final Pond Depth (ft)	Volume Check (Mgal)	Surface Area (ft^2)
August	0.724	-0.165	0.346	0.004	0.185	0.909	0.300	0.609	3.4	0.000	28,324
September	0.609	-0.113	0.501	0.016	0.404	1.013	0.350	0.663	3.7	0.000	27,048
October	0.663	-0.076	0.411	0.085	0.420	1.083	0.350	0.733	4.0	0.000	27,686
November	0.733	-0.034	0.265	0.224	0.455	1.188	0.300	0.888	4.7	0.000	28,324
December	0.888	-0.025	0.241	0.240	0.456	1.345	0.200	1.145	5.8	0.000	29,859
January	1.145	-0.024	0.246	0.321	0.543	1.687	0.200	1.487	7.1	0.000	32,322
February	1.487	-0.037	0.256	0.240	0.459	1.946	0.241	1.706	8.0	0.241	35,334
March	1.706	-0.069	0.273	0.191	0.395	2.101	0.395	1.706	8.0	0.395	37,483
April	1.706	-0.106	0.247	0.077	0.219	1.925	0.219	1.706	8.0	0.219	37,483
May	1.706	-0.162	0.240	0.016	0.094	1.800	0.300	1.500	7.2	0.094	37,483
June	1.500	-0.188	0.215	0.004	0.031	1.531	0.413	1.118	-5.7	0.000	35,573
July	1.118	-0.208	0.233	0.000	0.025	1.144	0.420	0.724	4.0	0.000	32,096
Total		**-1.206**	**3.474**	**1.420**	**3.688**		**3.688**			**0.949**	

ing Civil En	SUMMIT ENGINEERING, INC. Pond Water Balance - PHASE II	CAYMUS - RUTHERFORD Pond Water Balance - PHASE II Irrigation & Effluent Application Rates	PROJECT NO. BY: CHK:	2013044 GG 0

Applied Irrigation Area	Vineyard	10.0	acres
	Pasture		acres
Total Area Available for Irrigation	Vineyard		acres
	Pasture		acres

Month	Reference ET[a]	Pasture Crop Coefficient[b]	Vineyard Crop Coefficient[c]	Pasture ET[d]	Vineyard ET[d]	Precipitation[e]	Irrigation Demand[f]		Operating Days per Month[g]	Percolation Capacity[h]		Assimilative Capacity[i]		Effluent Applied		Excess Capacity
	(in)			(in)	(in)	(in)	(in)	(Mgal)	(d)	(in)	(Mgal)	(in)	(Mgal)	(Mgal)	(in)	(Mgal)
August	6.4	0.9	0.5	5.8	2.9	0.2	2.7	0.746	31	446.40	121.294	449.1	122.040	0.300	1.10	121.74
September	4.9	0.9	0.3	4.4	1.3	0.6	0.7	0.177	30	432.00	117.381	432.7	117.558	0.350	1.29	117.21
October	3.5	0.9	0.1	3.2	0.2	3.2	0.0	0.000	16	230.40	62.603	230.4	62.603	0.350	1.29	62.25
November	1.6	0.8	0.0	1.3	0.0	8.5	0.0	0.000	14	201.60	54.778	201.6	54.778	0.300	1.10	54.48
December	1.2	0.8	0.0	0.9	0.0	9.1	0.0	0.000	5	72.00	19.564	72.0	19.564	0.200	0.74	19.36
January	1.0	0.8	0.0	0.8	0.0	12.1	0.0	0.000	6	86.40	23.476	86.4	23.476	0.200	0.74	23.28
February	1.5	0.8	0.0	1.2	0.0	9.1	0.0	0.000	5	72.00	19.564	72.0	19.564	0.241	0.89	19.32
March	2.9	0.8	0.0	2.3	0.0	7.2	0.0	0.000	12	172.80	46.953	172.8	46.953	0.395	1.46	46.56
April	4.7	0.9	0.2	4.2	0.8	2.9	0.0	0.000	13	187.20	50.865	187.2	50.865	0.219	0.81	50.65
May	5.8	0.9	0.6	5.2	3.4	0.6	2.8	0.750	16	230.40	62.603	233.2	63.354	0.300	1.10	63.05
June	6.9	0.9	0.7	6.2	4.9	0.2	4.7	1.280	17	244.80	66.516	249.5	67.796	0.413	1.52	67.38
July	7.2	0.9	0.6	6.5	4.6	0.0	4.6	1.254	30	432.00	117.381	436.6	118.635	0.420	1.55	118.22
Total	**47.7**			**42.1**	**18.0**	**53.6**	**15.5**	**4.2**	**195.0**	**2808.0**	**763.0**	**2823.5**	**767.2**	**3.7**	**13.6**	**763.50**

(a) Average monthly reference evapotranspiration rates, see Climate Data Worksheet.
(b) Kc coefficients for pasture from Table 5-1, "Irrigation with Reclaimed Municipal Wastewater-A Guidance Manual"- California State Water Resources Control Board, July 1984 (San Joaquin Valley).
(c) Kc coefficients for vineyards from Table 5-12, Irrigation with Reclaimed Municipal Wastewater - A Guidance Manual, 84-1 wr, SWRCB.
(d) ET=ETo x Kc. A weighted value is determined on the basis of the available irrigated acreage of vineyard and pasture.
(e) Precipitation, 10-year rainfall event, see Climate Data Worksheet.
(f) Irrigation Demand = ET-Precipitation, inches. A weighted value is determined on the basis of the available irrigated acreage of vineyard and pasture.
(g) Number of operating days per month based on estimated irrigation days available based on 24-hr pre/post storm criteria for a 100-year return period. Summit Engineering, NBRID Capacity Study, April 1996.
(h) Design percolation rate is a maximum of 0.58 inches per day for the number of operating day per month. Design perc rate based on Napa County Soils Survey information (Bale Loam is the limiting soil @ 0.6 in/hr permeability) adjusted by a 0.04 safety factor to account for typical slow rate land application design methodology.
(i) Assimilative capacity is the sum of irrigation demand and percolation applied.